PD-ABC-033
68909

PROJECT PAPER

WATERSHED AND APPLIED RESEARCH DEVELOPMENT

(WARD)

655-0017

Agency for International Development

WATERSHED AND APPLIED RESEARCH DEVELOPMENT PROJECT
655-0017

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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete)
Amendment Number:
DOCUMENT CODE: 3

COUNTRY/ENTITY: CAPE VERDE

3. PROJECT NUMBER: 655-0017

4. BUREAU/OFFICE: AFRICA

5. PROJECT TITLE (maximum 40 characters): WATERSHED AND APPLIED RESEARCH DEVELOPMENT

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 98

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)
A. Initial FY 91 B. Quarter C. Final FY 95

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 91 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total DFA	1,700	100	1,800	8,300	700	9,000
(Grant)	(1,700)	(100)	(1,800)	(8,300)	(700)	(9,000)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		1,257	1,257		9,843	9,843
Other Donor(s)						
TOTALS	1,700	1,357	3,057	8,300	10,543	18,843

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) DFA	141	070				1,800		9,000	
(2)									
(3)									
(4)									
TOTALS						1,800		9,000	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)
080 | 090 | 960 | 020

11. SECONDARY PURPOSE CODE: 260

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BRW	BLW	R/AG	ENV	INTR	LAB	PVOU
B. Amount							

13. PROJECT PURPOSE (maximum 480 characters)

1. Strengthen the capacity of DGCSAFER to conduct SWC activities
2. Strengthen the capacity of INIA in on-farm research cropping.
3. Reinforce coordination among GOCV institutions in natural resource and agricultural development.

14. SCHEDULED EVALUATIONS
Interim MM 08 YY 93 MM 08 YY 95 Final MM 08 YY 98

15. SOURCE/ORIGIN OF GOODS AND SERVICES: ☐ OJ ☐ 941 ☐ Local ☒ Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment)

17. APPROVED BY
Signature: John W. Jones
Title: Acting A.I.D. Representative
Date Signed: MM 09 DD 30 YY 91

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
MM DD YY

(USAID em CABO VERDE)
EMBAIXADA AMERICANA
Office of the A.I.D. Representative
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ACTION MEMORANDUM FOR THE ACTING AID REPRESENTATIVE, CAPE VERDE

FROM: Acting General Development Officer, Willie C. Saulters

SUBJECT: Cape Verde Watershed Applied Research and Development (655-0017) Project Authorization

I. Proposed Action: Your approval is requested for a grant of $9 million from the Development Fund for Africa appropriation account for the subject project. It is planned that $1,800,000 of these funds will be obligated in FY 1991.

II. Discussion:

A. Description: This project is a follow-on activity of two successful projects in AID/Cape Verde's bilateral portfolio; the Watershed Development Project and the Food Crops Research Project. A combined evaluation of these two projects conducted in January - February, 1990 recommended combining the two projects under PVO/University management and shifting the priorities from institution building to institutional support and toward increasing sustainable agricultural production with focus on a selected watershed on Santiago Island. In addition to the DFA funds, about $8.4 million of monetized food aid will be used by the WARD project.

B. The goal of U.S. assistance under WARD is to increase sustainable agricultural production in Cape Verde and, concomitantly, increase incomes to producers.

The purposes of the project are to 1) strengthen the capacity of the Directorate General for Soil and Water Conservation and Rural Engineering to continue soil and water conservation activities with increased emphasis on productivity, 2) strengthen the capacity of the National Agricultural Research Institute in on-farm research, cropping systems/water management and monitoring/evaluation and 3) reinforce linkages among GOCV institutions in areas of natural resource and agricultural development.

C. Project outputs will include:

on-farm soil and water conservation, primarily through improved upland farming methods

off-farm soil and water conservation, primarily by building protective structures, afforestation and agroforestry using workfront labor paid with monetized food aid.

development of irrigable lands by developing wells and by constructing canals and diversions to link land to water resources

strengthened capacity of conservation, research and extension institutions

creation of a monitoring and evaluation system to track progress and assess the impact of project activities on the environment and the people of Cape Verde

D. Project inputs will be derived from a DFA grant of $9 million, a GOCV contribution of approximately $8.4 million in local currency generated from a Title II monetization Food Aid Program and a GOCV in-kind contribution of $1.4 million. Inputs will include long and short term technical assistance, long and short term training and commodity procurement over the seven year life of the project. The bulk of the cash inputs will be provided through a cooperative agreement with a PVO and/or university.

A U.S. PVO will be implementing a separate multi-year Title II monetization program, with the bulk of the local currency generations going to two separate accounts for the implementation of WARD Project activities. These separate accounts will be under the authority of the GOCV and the PVO implementing the Title II Program.

E. Financial Summary:

Estimated Budget (Expenditures) - $000

	Year One	LOP
USG - DFA		
Technical Assistance	494	4,822
Training	60	1,244
Commodities	270	1,015
Other	192	1,919
subTOTAL	1,016	9,000

G. Special Concern

Although eligible for 22 CFR 216.2 exclusion, it is recommended that "an environmental follow up of the project activities be carried out simultaneously with the project implementation in the form of a monitoring/mitigation system to minimize possible adverse effects and guarantee the safety and security of the rural poor."

III. Waivers:

None required

IV. Justification to Congress:

V. Recommendation: That you sign below and the attached PP Data Sheet and Project Authorization, and thereby approve a Project Grant of $9.0 million for the Watershed and Applied Research Development Project (WARD) which has been concurred in by the REDSO/WCA Director in Abidjan (16912), dated 26 Sept 1991).

Approved: John W Jones

Disapproved: _____

Date: 9/30/91

Attachments:

1. Project Authorization.

2. Project Paper

Clearances:

As noted in text

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Washington D.C. 20090—6950

PROJECT AUTHORIZATION

Name of Country: Cape Verde

Name of Project: Watershed and Applied Research Development

Number of Project: 655-0017

1. Pursuant to Section 496 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Watershed and Applied Research Development Project (the "Project") for the Republic of Cape Verde (GOCV or "the Grantee"), involving planned obligations of not to exceed Nine Million United States Dollars (US $9,000,000) in grant funds (the "Grant") over a period of seven years, two months from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project. The planned life of project is seven years from the date of initial obligation.

2. The Project consists of assistance to the Government and people of Cape Verde in developing sustainable agriculture through: 1) continued support to both on-farm and off-farm soil and water conservation measures, 2) applied research in water and soil conservation, hydrology, cropping systems, varietal improvements, and agroforestry, 3) training of GOCV personnel in soil and water conservation activities, 4) support to the GOCV in strengthening the capacity of agriculture extension services to educate farmers on appropriate soil and water conservation techniques, and 5) development of on-going systems to monitor the impact of all soil and water conservation activities. The Project will finance the costs of commodities, technical assistance and consulting services, U.S., host country, and third country training, workshops, and other services necessary to achieve the Project purposes.

3. The Project Grant Agreement(s), which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with A.I.D. regulations and delegations of authority, shall be subject to the following essential terms, covenants, and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Project shall have their source and origin in countries included in A.I.D. Geographic Code 935, except as A.I.D. may otherwise agree in writing. However, all project vehicles procured under the Project will their source and origin from the U.S. Except for ocean shipping, the suppliers of commodities or services shall have countries included in A.I.D. Geographic Code 935 as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of countries included in A.I.D. Geographic Code 935.

b. Conditions Precedent

(1) First Disbursement. Prior to any disbursement, or the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Grantee will, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., the following:

(a) A statement of the name of the person(s) acting on behalf of the Government of Cape Verde for purposes of implementation of the WARD project, together with a specimen signature of such person(s).

(b) A statement confirming that a WARD project Coordinating Council has been designated, along with the names of the persons comprising the council and the name of the chairperson of the council.

(c) A statement confirming that a special account has been established, along with the number of that account, for deposit of all P.L. 480 revenues that are to be used by the DGCSAFER for soil and water conservation construction and afforestation activities.

(d) A statement confirming that a special account has ben established, along with the number of that account, for deposit of P.L. 480 revenues that are to be used by INIA to support the training and research aspects of the WARD project.

c. Covenants

The Grantee covenants that:

(1) The individuals trained under the WARD project will become members of he staff of INIA or DGCSAFER upon completion of training, unless work performance proves unsatisfactory.

(2) The implementing offices of the Ministry of Rural Development and Fisheries will maintain thorough and up to date inventory records, documenting receipt, use, and disposition of A.I.D.-financed commodities.

(3) The Ministry of Rural Development and Fisheries will ensure that all commodities procured under the Food Crop Research Project and Watershed Development Project are made available to personnel engaged in implementing the WARD project.

(4) No funds provided under the Grant, nor goods or services financed under the Grant shall be used in connection with the purchase, application, transport or storage of pesticides other than those approved by the United States Environmental Protection Agency for the particular purpose for which they are to be used.

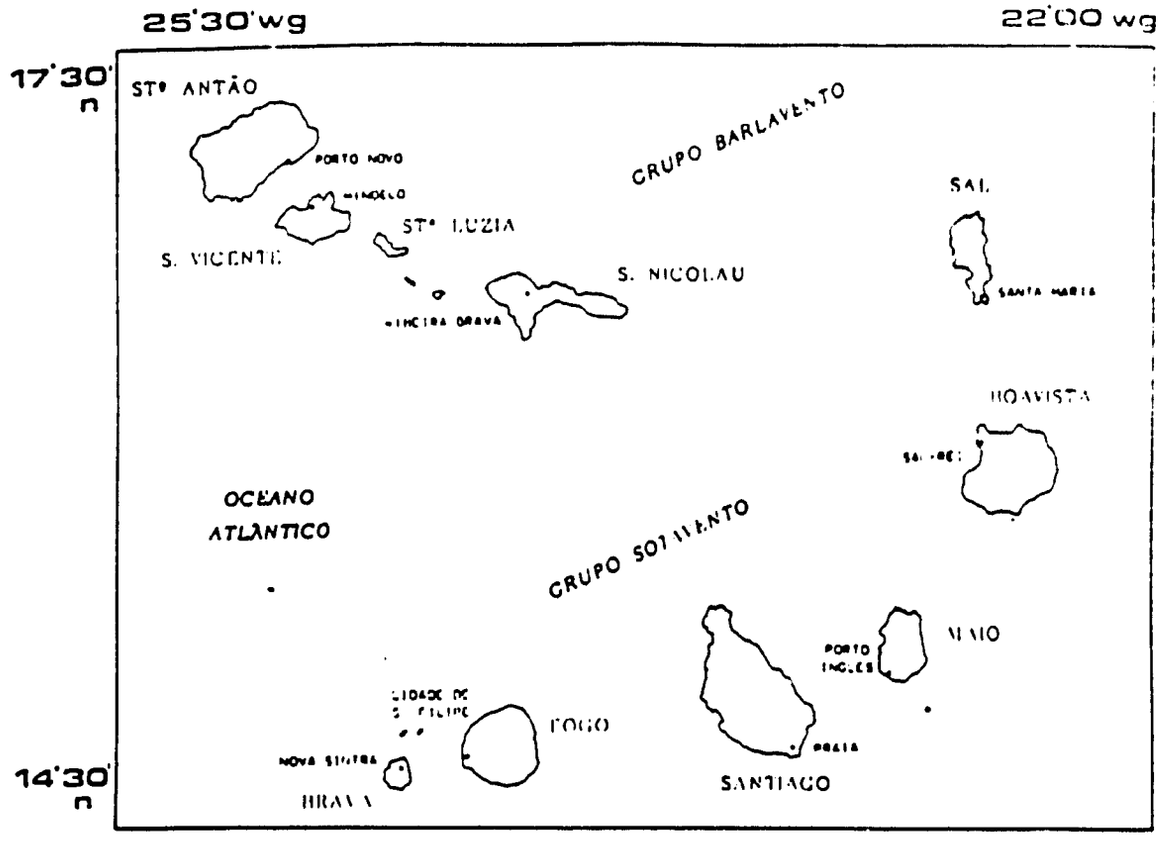
(5) The Ministry of Rural Development and Fisheries and project management will make their best efforts to monitor, assess, and mitigate any adverse environmental impacts resulting from project activities.

John W. Jones

John W. Jones
Acting A.I.D. Representative
Cape Verde

9/30/91
Date

Clearances as Stated on Action Memorandum



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Arquipélago origem vulcânica
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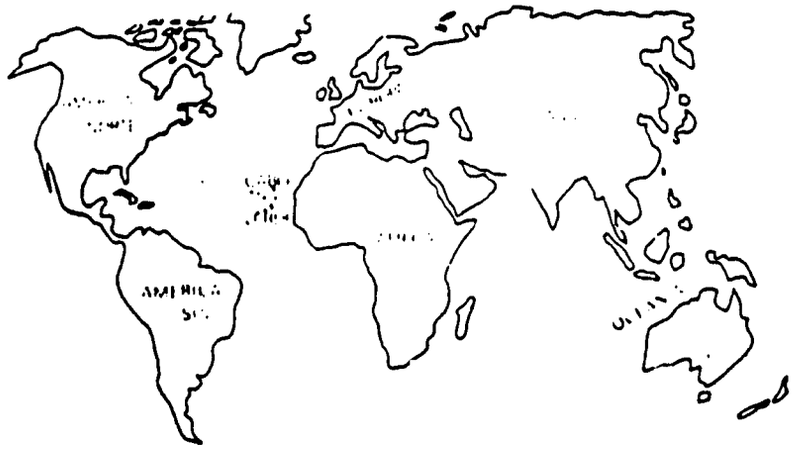
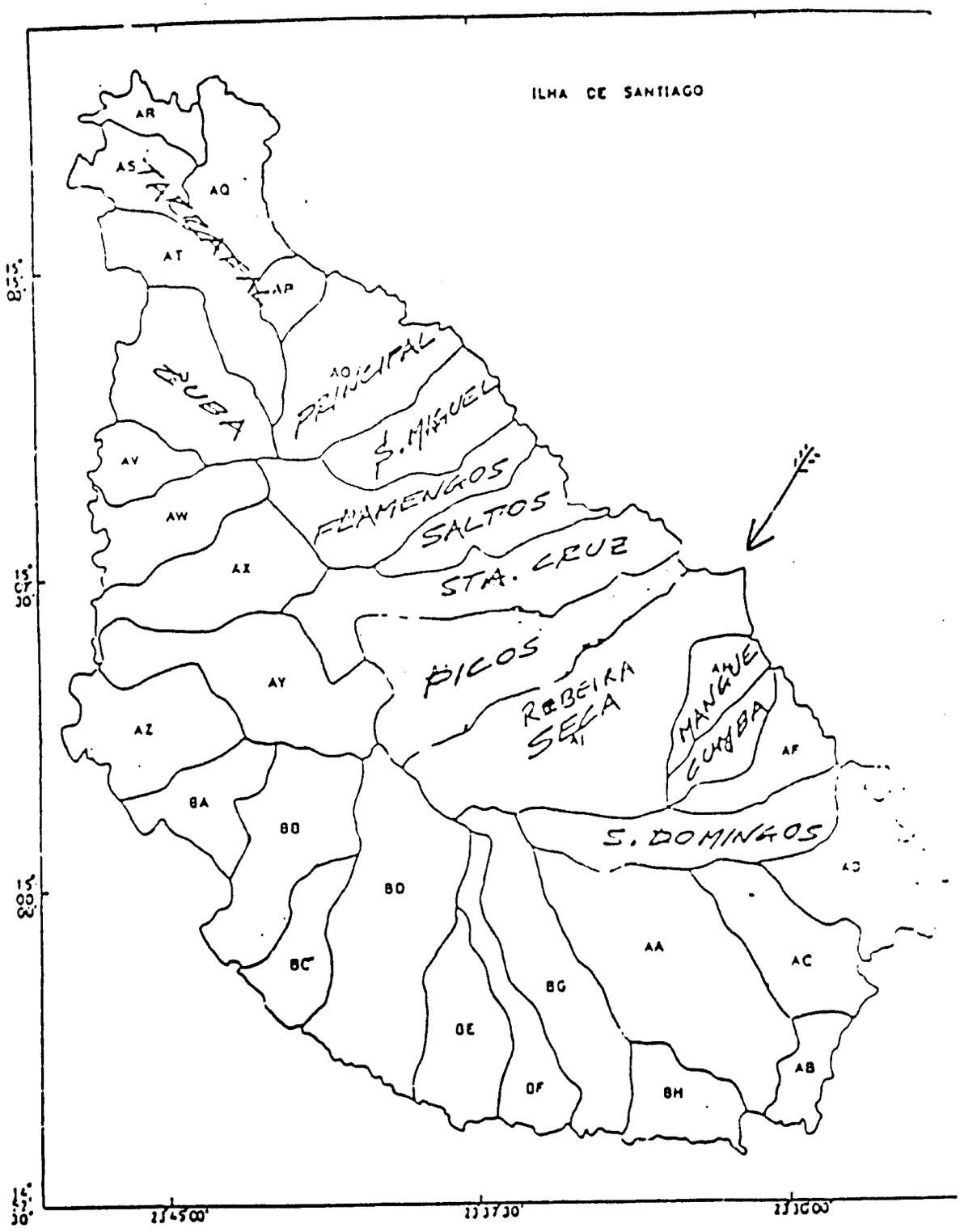


		(Area em Km²)
Barlavento:	Sto. Antão	— 779
	S. Vicente	— 227
	S. Luzia	—
	S. Nicolau	— 388
	Sal	— 216
	B. Vista	— 620
Sotavento:	Maio	— 269
	Santiago	— 991
	Fogo	— 476
	Brava	— 67


ILHA DE SANTIAGO
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ZUBA
PRINCIPAL
S. MIGUEL
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PICOS
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RIBEIRA SECA
MANGUE
CUMBA
AF
AZ
BA
BB
S. DOMINGOS
BD
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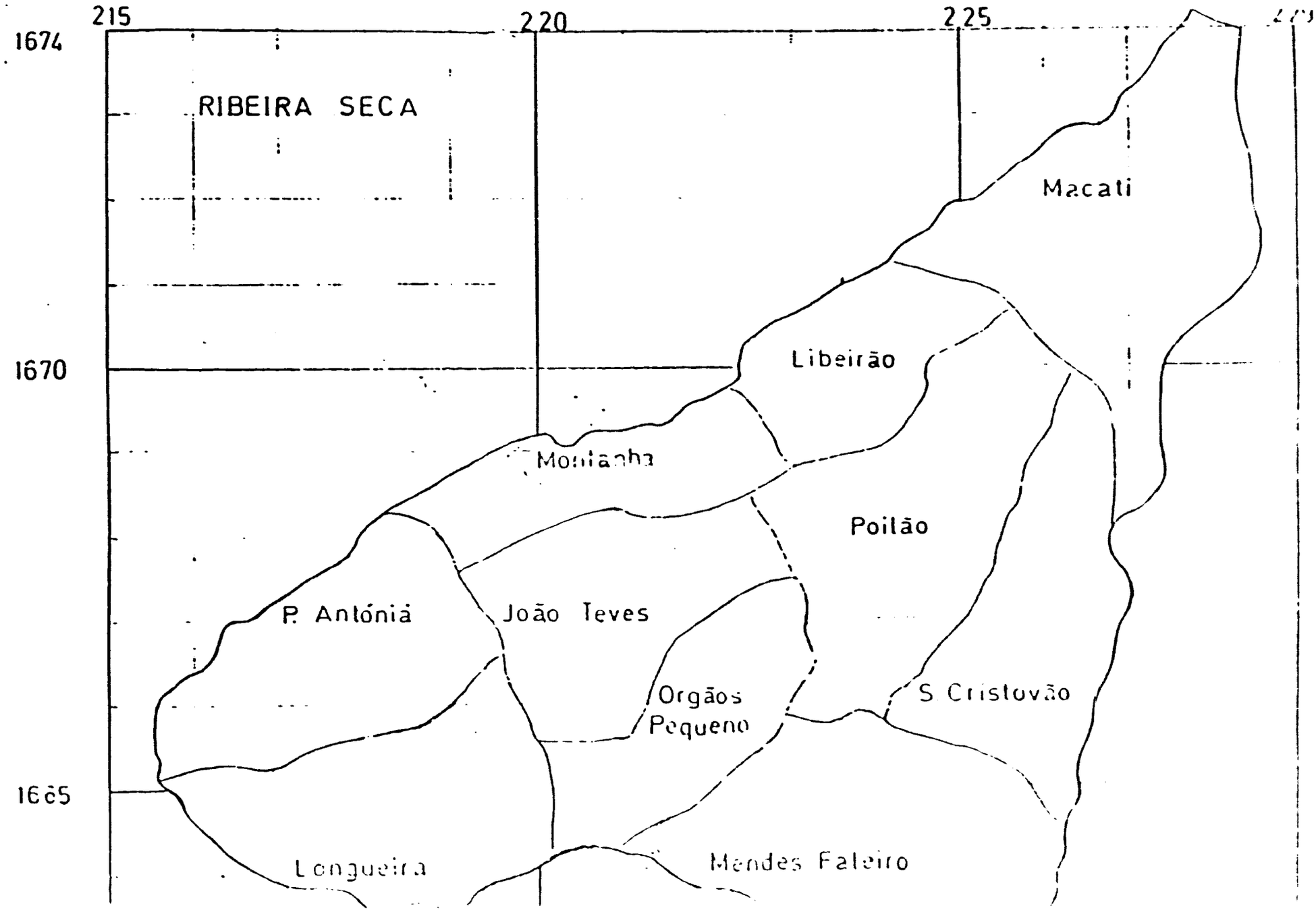
15° 07' 30"
15° 00' 00"
14° 52' 30"
23°45'00"
23°37'30"
23°30'00"


215
220
225
1674
1670
1665
RIBEIRA SECA
Macati
Libeirão
Montanha
Poilão
P. Antónia
João Teves
Orgãos Pequeno
S Cristovão
Longueira
Mendes Faleiro

LIST OF ACRONYMS AND ABBREVIATIONS

AID	Agency for International Development
CBWF	Community-Based Workfront
CDP	Center for Livestock Development
DCSEA	Departamento de Ciencias Sociales e Economia Agricola (of INIA)
DGCSAFER	Direcção Geral de Conservação de Solos, Agua, Florestal, e Engineria Rural (MDRP) (same as DGCSFER)
DGER	Directorate General, Rural Extension (MDRP)
DGFA	Directorate General, Agrarian Promotion (MDRP)
DGP	Directorate General, Livestock (MDRP)
DSF	Direcção dos Serviços Florestais/Forestry Services Division (of MDRP)
EMPA	Empresa Publica de Abastecimento/Public Supply Enterprise
EOPS	End of Project Status
FAO	Food and Agriculture Organization (of United Nations)
FAP	Fomento Agropecuario/Agricultural and Livestock Input Supply
FCRP	Food Crops Research Project
FSR&E	Farming Systems Research and Analysis
FSR&E	Farming Systems Research & Extension
GEP	Gabinete de Estudos e Planeamento/Office of Studies and Planning (of MDRP)
GIS	Geographic Information System
GOCV	Government of Cape Verde

GRA	Cabinet for Agrarian Reform
IFAD	International Fund for Agricultural Development
INC	National Institute of Cooperatives
INIA	Instituto Nacional de Investigação Agraria/National National Agricultural Research Institute (of MDRP)
IRR	Internal Rate of Return
ISNAR	International Service for National Agricultural Research
ITCZ	Intertropical Convergence Zona
JRH	Water Resources Board/Junta de Recursos Hidricos
LOP	Life of Project
MDP	Movimento para Democracia/Movement for Democracy
MDRP	Ministerio do Desenvolvimento Rural e Pesca/Ministry of Rural Development and Fisheries
MIS	Management Information System
NGO	Non-governmental Organization
PACD	Project Activities Completion Date
PAICV	Partido Africano para a Indenpendencia de Cabo Verde/ African Party for Cape Verdean Independence
PID	Project Identification Document
PL480	Public Law 480 (of U.S. Congress)
PLI	People Level Impact
PMU	Project Management Unit
PP	Project Paper
PVO	Private Voluntary Organization

RAP	Rural Assistance Program/Programa de Asistencia Rural (of WDP)
RD&E	Research, Development, and Extension
REDSO/WCA	Regional Economic Development Service Office for West and Central Africa (of USAID)
SAI	Sheladia Associates, Inc.
SOW	Scope of Work
SWC	Soil and water conservation
TA	Technical Assistance
USAID	United States Agency for International Development
WARD	Watershed and Applied Research Development (project)
WDP	Watershed Development Project

WATERSHED APPLIED RESEARCH AND DEVELOPMENT PROJECT

EXECUTIVE SUMMARY

A. Grantee - Government of Cape Verde (GOCV)

B. Implementing Agency - Ministry of Rural Development and Fisheries (MDRP)

C. Financial Plan

USG - Development Assistance		$9,000,000
Technical Assistance	4,822,000	
Training	1,244,000	
Commodities and Supplies	1,015,000	
Operational Expenses	389,000	
External Eval. & Audit	375.000	
Project Management	305,000	
Contingency	850,000	
GOCV - PL 480		$8,443,000
Work Front Pmnts.	7,248,000	
In-country Training	245,000	
Project related local costs	750,000	
GOCV Contribution		$1,400,000
LOP Funding		$18,843,000

D. Term of Project October, 1991 - September, 1998

PACD 30 September, 1998

E. Goal and Purpose

The goal of U.S. assistance under WARD is to increase sustainable agricultural production in Cape Verde and, concomitantly, increase incomes to producers. Agricultural production includes irrigated and rainfed crops, forage, livestock, and forestry/agroforestry products.

The purposes of the project are:

1. To strengthen the capacity of the Directorate General for Soil and Water Conservation and Rural Engineering and its successor institute to continue soil and water conservation activities with increased emphasis on agricultural productivity.

2. To strengthen the capacity of the National Agricultural Research Institute and its successor in on-farm research, cropping systems/water management and evaluation/monitoring.

3. To reinforce linkages among GOCV institutions in areas of natural resource and agricultural development pertaining to the above.

F. Project Elements

WARD provides assistance in three broad areas: soil and water conservation, agricultural research and extension, and forestry/agroforestry. Each of these areas is of major importance to the sustainability of Cape Verde agricultural production. Planning, research, and development activities carried out under each of these activities will be focused on a target watershed, Ribeira Seca, in order to test replicable development techniques and methodologies. Emphasis will be on increasing agricultural productivity through 1) improved on- and off-farm soil and water conservation measures, 2) cropping systems and water management research using an adaptive, on-farm research methodology, 3) and improved integration of trees, shrubs, and grasses into agroforestry and sylvo-pastoral systems. WARD activities will also affect development of other watersheds on Santiago and other islands through its assistance to institutions (training, technical assistance and commodity import.)

Soil and water conservation activities will be based on the design and application of land-use systems that preserve or enhance soil fertility and water retention. Cropping practices that reduce soil loss, such as hedgerow agroforestry, stripcropping, and contour tillage will be promoted. Limited construction of drop-inlet structures on tributory and main channels will accumulate and increase the depth of retained sediments, providing some increase of water storage. A small amount of irrigable land will be developed for demonstration purposes by constructing diversions, wells, lined canals or other structures in the target watershed.

WARD will continue supporting afforestation activities by planting an additional three million trees on twelve watersheds. Forestry activities will be expanded to include applied research on new tree, shrub, and grass species for use in Cape Verde. It will promote agroforestry, fruit production, and sylvo-pastoral

development by supporting technology development in these areas, working with extension personnel to enlist farmer participation, and conducting studies on forest product use and alternative marketing opportunities.

WARD activities in soil and water conservation and forestry will be complemented by a strengthened agricultural research institute. On-farm studies of irrigated and rainfed cropping techniques, water management practices, and adapted varieties will aim at increasing productivity per unit land. A monitoring and evaluation capacity will be developed in order to assess the impact of activities aimed at improving sustainable agricultural production. Finally, research-extension linkages will be improved by training extension workers and engaging them more fully in the research and technology transfer process.

The project will be implemented by a combination of a Private Voluntary Organization (PVO) and/or a University under a cooperative agreement. A PVO will also be involved in the project through management of the PL 480 Title II program, and possibly extension services. The role of a PVO(s) in the project will be further considered once Title II proposal(s) have been received and reviewed by OAR Cape Verde, the GOCV and REDSO/WCA.

G. Background

WARD represents a synthesis of USAID development strategy initiated under two previous assistance projects - Watershed Development and Food Crop Research. WARD represents an important turning point in the evolution of project assistance in Cape Verde. It recognizes explicitly that agricultural production is intimately tied to and dependent upon effective natural resource management, and that sustainability in the agricultural sector cannot be achieved in isolation from other factors. WARD proposes to use achievements of past projects to move beyond enhancing agricultural potential to increasing agricultural production on an ecologically sound and sustainable basis. WARD will incorporate extension activities directly into target watershed activities and provide institutional support at a more global level through training of technicians, which will serve both the research and extension needs of Cape Verde.

H. Project Personnel

Consortium:

Long Term	
Watershed Manager/Team leader	6.5 person/years
Watershed Agronomist	5.5 person/years
Social Scientist	2.0 person/years
Short Term	
Recurring	60 person/months
Regular	29 person months

USAID:

Project Manager	7+ person/years

I. Technical Summary Findings

Soil and Water Conservation

Activities to conserve soil and water in Cape Verde predate independence. Many of these activities relied on erosion control structures and reforestation that continue to the present and which were supported by USAID. Despite this effort, soil erosion continues at rates that mitigate against sustainable agriculture. To arrest this trend, WARD will encourage and assist farmers in implementing improved land husbandry methods: contour terraces, agroforestry, strip cropping, improved plant densities, etc. By EOP it expects participating farmers to have treated the majority of the upland surface suitable for cropping in WARD's targeted watershed, Ribeira Seca, and a significant amount of land on other watersheds.

Off-farm soil and water conservation methods in Cape Verde have relied heavily on a variety of large and small structures to arrest runoff and accumulate sediment. In view of the structures already built and the questionable efficacy of some, WARD will gradually reduce the construction of new structures. It will upgrade and rehabilitate key structures and those in danger of collapse.

WARD will develop appropriate diversions and canals to convey water to potentially irrigable lands and assist farmers to develop up to nine hectares of irrigable land on the target watershed.

Forestry and Sylvo-Pastoral Development

In the forestry and sylvo-pastoral sector, WARD will continue past successful activities in support of DGCSAFER as needed. WARD will also initiate new activities to help stabilize hillslopes and promote increased agricultural production. Proposed WARD activities specific to the forestry sector are as follows:

- Continuing support to DGCSAFER in the production and plantation of 3 million tree seedlings and the integration of planning methodologies into the Forestry Services Directorate.

- Forestry, agroforestry, and sylvo-pastoral research investigating new species of trees, shrubs, and grasses and socially acceptable agroforestry and agro-sylvo-pastoral systems.

- Agroforestry, fruit production and sylvo-pastoral development packages for use by extension personnel in rrecruiting farmer support and cooperation.

- Promotion of private sector forestry activities by study of the potential for private sector tree seedling production, tree planting, fuelwood harvest and marketing, fabrication of forestry materials, and/or sales of secondary tree products.

Agricultural Research

WARD will support continued institutional development of INIA in several areas: on-farm research methodology, cropping systems and water management studies, monitoring and evaluation, and research management. Past assistance to INIA has laid a foundation for continued support in these areas. A more multidisciplinary, on-farm research methodology, however, will allow for stronger research-extension linkages and increased farmer input into the research process.

WARD will assist in building INIA's capacity to conduct applied cropping systems research through selected research activities in a targeted watershed, well-planned short and long-term training activities, and technical assistance. Specific WARD activities in cropping systems research over the LOP should be in the following areas: water management research (irrigation management, water-use efficiency, fertilizer-water response, water harvesting, drip irrigation), cropping systems research, (contour tilling, hedgerow agroforestry, stripcropping, terracing, etc.), and varietal improvement (root and tuber crops, forage crops, dryland crops for addressing soil erosion problems, and irrigated horticultural crops).

18

INIA's capacity to monitor and evaluate impacts of activities aimed at increasing sustainable agricultural production, including off-farm resource management, should be developed. Cape Verde is in great need of the capacity to measure and analyze the effectiveness of its conservation and research programs. Without this capacity, forward planning is grounded on unreliable assumptions and risks wasting scarce resources.

A modest amount of technical assistance and training should be furnished on specific topics of research management and administration, including proposal writing, research priority setting, records keeping, and administration.

Financial

The assumed benefits from the WARD project outweigh costs (development assistance, GOCV contribution and PL 480) by about three to one. The stream of benefits is positive when the time value of money is taken into account; the internal rate of return (IRR) is over 10%. Project benefits are assumed for all of Cape Verde although most directly for the target watershed. Benefits will be from increased yields on irrigated and rainfed land, from increases in livestock production, from the value of firewood resulting from WARD forestry activities and from additions to irrigated land. It is also assumed that benefits will continue to accrue for several years after project completion. Costs of predecessor projects are not included in the analysis.

Institutional

WARD will benefit directly from the institution building efforts of the predecessor projects, WDP and FCRP (655 0013 and 655 0011). Deficiencies in technical training and infrastructure were identified in the joint evaluation of these two projects in February 1990. These deficiencies have been addressed by WARD in terms of more appropriate training, technical assistance and commodity procurement.

The Government of Cape Verde is considering reorganizing its rural development activities into semi-autonomous institutes. This may require some adjustments in WARD implementation arrangements which are addressed in the body of the report.

J. The Role of PL 480

A U.S. PVO has submitted a multi-year PL 480 Title II monetization proposal which will be closely inter-related with WARD activities. Most of the local currency generated by the program

will be deposited into special accounts for 1) continued maintenance and construction of soil and water conservation structures and afforestation, and 2) to fund local costs to carry out research and training under WARD. The program is designed to reduce the dependency of Cape Verdeans on donor supported public workfronts by limiting PL 480 funding to high priority soil and water conservation activities.

K. Conditions and Covenants

Conditions precedent include a statement designating the person responsible on the part of the GOCV with specimen signature, confirmation of the establishment of a WARD Coordinating Council and confirmation that special accounts have been set up for SWC, training and agricultural research.

In addition to standard covenants, the Project Grant Agreement will contain special covenants regarding the continuity of GOCV personnel trained under the WARD project, records of receipt and disposition of AID-financed commodities, limits on the use of pesticides and monitoring of environmental impact. See Section V of the Project Paper.

I. PROJECT BACKGROUND AND RATIONALE

A. Setting

Cape Verde is an archipelago of ten islands and five islets located approximately 650 km west of the coast of Senegal and 1,400 km south of the Canary Islands. The islands are divided into two groups: the Ilhas de Barlavento or windward islands (Santo Antão, São Vicente, Santa Luzia, São Nicolau, Sal, Boa Vista, and some islets) and the Ilhas de Sotavento or leeward islands (Maio, Santiago, Fogo, Brava, and several islets). Together, they occupy approximately 1,522 square miles (4,033 km^2) - an area about the size of Rhode Island.

Cape Verde is challenged by a number of physical and climatic factors which impede its economic development. Foremost among these constraints are those related to sustainable agricultural development: highly variable and low rainfall regime; fragile soil and water resources; low arable land availability; and seasonal labor shortages.

Climatic constraints which inhibit productive rainfed agriculture are perhaps the greatest limiting factor to development of the islands. The climate on Santiago, the island where WARD will be implemented, is controlled by the same weather systems as the Sudano-Sahelian zone of West Africa - the intertropical convergence zone (ITCZ). The ITCZ is marked by periodic stagnation of the Atlantic subtropical high. Centered over Cape Verde, this causes drought which may last several years at a time. The ITCZ moves northward from equatorial Africa starting in April/May, with the apex of its northward migration occurring in late August. Thus, isohyets are generally oriented east to west placing Cape Verde, lying at approximately 17 degrees latitude, at the northern limit of the ITCZ in a generally low rainfall regime. In addition, there is strong orographic influence on average precipitation. As a result, spatial, temporal, and elevational variation in rainfall is high. On Santiago, average rainfall varies from 200 mm or less on the low coastal plains to over 900 mm in the higher elevations. Rains generally come between July and October and occur as brief, torrential downpours.

Over 75% of Cape Verde's agrarian population engages in some rainfed production of corn and beans. Rainfed yields, however, are low due to low water availability, low soil fertility, high growing season temperatures, and poor cultural practices that promote high evapotranspiration and soil loss.

Other factors also limit the productive and competitive potential of Cape Verde. Its isolation from world markets and distance from neighboring trade partners, combined with high

transportation costs for importing and exporting goods, puts Cape Verde at a disadvantage in terms of trade. The country's multiple island set-up, with its international airport on one island (Sal), its major port on another island (São Vicente), and its capital and seat of government on still another island (Santiago), further complicates matters. Foreign exchange is generated primarily through airport landing fees and remittances from Cape Verdeans working abroad.

In assisting Cape Verde to move toward a more sustainable and viable economy, these constraints to agricultural production must be addressed. Securing a sustainable resource base should be given highest priority in order to improve conditions for food security, increase potential for export agriculture, and ensure Cape Verdeans more productive livelihoods.

B. WARD Overview

The Watershed and Applied Research Development Project (WARD) represents a logical synthesis of successful past efforts of OAR/Cape Verde to improve natural resource management and agricultural productivity. It builds upon the knowledge gained and lessons learned from two completed projects: the Watershed Development Project (WDP, 655-0013) and the Food Crop Research Project (FCRP, 655-0011). WARD will continue to provide assistance in natural resource development and maintenance through the provisioning and programming of some of the proceeds from a multi-year PL 480 Title II monetized food aid program managed by a PVO.

WARD is an important turning point in the evolution of USAID project assistance in Cape Verde. It recognizes explicitly that agricultural production is intimately tied to and dependent upon effective natural resource management, and that sustainability in the agricultural sector cannot be achieved in isolation. WARD proposes to move beyond enhancing agricultural potential to increasing sustainable agricultural productivity.

WARD will contribute to environmental stabilization and agricultural production in Cape Verde by:

- providing funding and technical assistance (TA) to rehabilitate and improve soil and water conservation (SWC) structures that, through design flaws or poor maintenance, risk collapse;
- constructing new SWC structures where they play a critical role in watershed development;
- expanding the role of vegetation management in watershed development;

- providing technical assistance to the National Agricultural Research Institute (INIA) in the areas of: on-farm research; improved cropping, livestock, and agroforestry systems; water management; and monitoring/evaluation; and,

- improving research-extension linkages.

Publicly-funded workfronts will continue to provide labor for SWC activities. Forestry activities will also continue, but with more emphasis on agroforestry and sylvo-pastoral systems.

A target watershed will be utilized for experimentation, demonstration, and monitoring of project interventions in natural resource conservation and for linking agricultural research with natural resource protection. Focusing these activities in the target watershed will create an opportunity to closely monitor and evaluate interventions developed and tested during the project. However, some activities, such as tree, shrub, and grass planting and maintenance of structures, will continue in other watersheds.

WARD will continue to work with INIA to improve crop and livestock practices (with an emphasis on soil and water management), identify crop and forage varieties better adapted to the islands' climate, and promote more effective technology transfer. It will build upon significant advances made by INIA and the General Directorate for Rural Extension (DGER) by testing improved varieties and cropping practices on farmers' fields. WARD will also work to improve soil management and water-use efficiency under rainfed and irrigated cropping conditions.

The project will build INIA's capacity to monitor and evaluate the impact of natural resource protection interventions on soil and water conservation and agricultural production, and on the livelihoods and well-being of rural Cape Verdeans.

In the area of technology transfer, the WARD project will train extension agents to work in the target watershed. These agents will participate in on-farm trials, promote farmer-researcher feedback, aid in the monitoring and evaluation of rural works, extend technologies to farmers in the general project area, and assist communities in self-help, mini-projects relating to SWC and agricultural production.

C. Lessons Learned From Previous USAID Projects

The design of the WARD Project is based on OAR/Cape Verde's experience with two predecessor projects, the Food Crops Research Project (655-0011) and the Watershed Development Project (655-0013).

The Food Crops Research Project was authorized in August 1982, with a life-of-project (LOP) amount of $4,688,000. The current PACD is August 30, 1992. The Project Purpose is "to assist the GOCV Ministry of Rural Development and Fisheries (MRDP) to develop and implement an adaptive agricultural research capacity and capability at I.N.I.A., the National Agricultural Research Institute". Under the project, technical assistance has been provided to INIA through a Title XII university. In addition, the project has funded 9 MS and 2 Ph.D. degrees in various agricultural disciplines. Facilities constructed under the project have included a management/administration center, a soils lab, a plant physiology lab, plant protection labs, an agronomy field lab, a library, and four houses. The project also provided significant levels of commodity procurement.

With project support, INIA has tested and released improved vegetable varieties. These have included: (1) disease-resistent tomato varieties; (2) a disease-resistent sweet potato that yields 50 percent more than local varieties; and (3) warm weather cabbage and lettuce that have the potential of significantly expanding the growing season. INIA is also conducting research on purge nuts, an oil producing nut used for making fuel and soap, and coffee. (Coffee is rust free in Cape Verde and there exists, therefore, the potential of exporting coffee seed). In addition, INIA researchers and advisors have also worked in various other areas, such as drip irrigation, the biological control of grasshoppers, and the analysis of food policy in Cape Verde.

The Watershed Development Project was originally authorized in June, 1984, with an authorized LOP of $7,611,000. The current PACD is December 31, 1991. The Project Purpose is "to protect and develop the soil and water resources in project watersheds and thereby assist in reducing the underlying causes of food shortages in Cape Verde". Under the project, the DGCSAFER has received technical assistance from a U.S. consulting firm, as well as commodity assistance and training. By early 1990, the time of the evaluation, the project had completed approximately 12,500 structures, including contour furrow and rock walls, checkdams, embankment groins, catchment tanks, and reservoirs. In addition, more than 4 million trees had been planted and approximately 286,000 person days of employment had been provided.
These projects were jointly evaluated in early 1990. The evaluation concluded that these activities were "well designed, competently managed, and effectively assisted by project technical advisors." Inputs to the projects in personnel, commodities, and training were provided at approximately the planned levels - The evaluation team concluded that the Food Crops Research Project's training program had produced a staff of researchers of strong potential. INIA's research planning, strategic and administrative capacity were rated as good by the evaluation team, though weaknesses remained in analysis and in the dissemination and utilization of outputs. The evaluation noted that, while research

products had begun to flow, field experiments and demonstrations were still limited in number. According to the evaluation, "INIA is only now at the point where it can begin to develop research applications with direct utility to conservation and agriculture". At the same time, while noting the physical accomplishments of the Watershed Development Project, the evaluation team raised concerns about the durability and maintenance of the structures created and the failure to carry out integrated watershed planning. (Since the evaluation, phased watershed development plans have been completed for most of the project watersheds).

In summary, the evaluation team concluded that, "Both projects have achieved a great deal. INIA, while still in the early stage of its long-term development, is set on a sound path of growth that will further mature and accelerate with the return of trainees and with broadening and improvement in its research program and strategies.... The WDP experience demonstrates the feasibility of protection of watershed resources. Likewise, the capacity of INIA to produce research results applicable to both agriculture and conservation can now been foreseen." In particular, the team noted, watershed efforts, which in the past have been limited to afforestation and the construction of certain structures (checkdams, contour rockwall terraces, reservoirs, and the like), can begin to diversify.

The above efforts endow the WARD Project with a legacy of knowledge that will facilitate its implementation and increase its opportunity for success. The following paragraphs summarize the most important of these lessons learned.

Capacity of GOCV.

Both in the conduct of its operations with USAID as well as the management of its economy, services, and resources, the GOCV demonstrates a talent for ordered, conscientious achievement. Part of this talent results from training supported by AID project-related activities; much of it also comes from experience gained in the management of resources in a country where scarcity is a dominant constraint.

Evaluations and observations show that there needs to be a better integration of GOCV personnel into project management and technical activities. WARD will capitalize on previous training and institutional support activities by transferring more responsibility to qualified counterparts and by fostering a larger role for them in planning and management. GOCV personnel will have more responsibility (and credit) for reports. WARD will attempt to recruit short term technical assistance from the ranks of Cape Verdeans, perhaps through association with a local consulting firm.

Research leaders working with WARD will be encouraged to relate anticipated results to project and national objectives --

how results will be translated into increased production; are they sustainable; what effects will they have on the environment. Research leaders will be trained in proposal writing, including the planning and specification of the roles of extensionists, social scientists, farmer cooperators and project monitors.

Sustainability of Watershed and Agricultural Research Development.

Sustainability is a concept that profoundly influences economic, social, institutional and technical issues in Cape Verde. Limited soil and water resources, an expanding population, and an economy dependent upon overseas remittances and foreign assistance causes concern for the future. The unpredictability of concessional food imports poses a tremendous need to promote the evolution of the economy toward a more sustainable footing. Yet, up to the present, Cape Verde continues its reliance on publicly employed workfronts producing structures of sometimes questionable worth -- rock walls, gully plugs, sediment retention dams -- without undertaking complementary, community-based actions to improve agriculture. Despite GOCV investments in structural erosion control, upland erosion continues, its residues accumulating as sediment behind costly structures. As upland soils become increasingly shallow, soil moisture storage decreases and water supply becomes less reliable to upland as well as downstream users.

Reversing this trend requires inculcating alternative land use practices in Cape Verde's rural population, a class largely ignored other than as a workfront labor source. Part of the social sustainability of improved land use comes from assuring that rural people have a voice in decision making -- to chose or reject options; its technical sustainability comes from managing land so that soil erosion does not exceed the rate of soil formation; its economic sustainability derives from improved soil productivity, much of which derives from research results communicated through the extension process. Beyond land-related issues, institutional sustainability depends upon GOCV actions. Is it sufficiently interested in WARD to guarantee its follow-up after project conclusion? Will long-term trainees return to Cape Verde's civil service and will they remain after project conclusion? What measures will the GOCV undertake to encourage stability within its civil service corps? Will the GOCV be able to develop alternatives to unsustainable workfront labor as a key element of rural development?

Sustainability also derives from project adjustments identified by project monitoring. Insufficient information exists about the costs and benefits of rural works and their related people level impacts. We need to measure and evaluate the effectiveness of WARD's outputs and relate these to its objectives: Is WARD saving soil and increasing land productivity in ways that

are beneficial to people? Because of these benefits, will people continue WARD's methodology on their own initiative after the EOP?

Need for Supplemental USAID Mission Management.

Large, complex projects often encounter difficulty interfacing with their sponsor. This is particularly acute in countries such as Cape Verde where the USAID mission is limited to two direct hires. Under the new WARD project this management deficiency should be addressed by project funding of a well qualified PSC project manager.

Relevance of Technical Assistance to WARD Activities.

WARD needs to benefit from GOCV staff contributions to TA documents; we need to draw more from local talent for TA; GOCV staff should be the principal authors of TA technical documents; GOCV should have a review authority of TA outputs; hands-on training of counterpart staff should be a TA term of reference.

Need for Improved Collaboration.

WDP forestry activities became disaggregated from the institutional structure of DGCSAFER. Part of this resulted from independent financing of some of the Forestry Division's (DSF) activities from non-WDP sources; part of it came about from personality differences within DGCSAFER. To avoid institutional conflicts, WARD requires collaboration among departments of the GOCV: it depends on interdisciplinary collaboration in which researchers, extensionists, farmer co-researchers, and individuals monitoring WARD outputs work interactively. WARD also requires strategies to assist inter-donor collaboration. To do otherwise risks strategic and technological conflicts arising among projects funded by different donors.

D. Relationship of WARD to AID Policies

The WARD project has been designed within the context of the Development Fund for Africa Action Plan issued in 1989. That Plan calls for focusing AID assistance in Africa to achieve four strategic objectives, two of which are particularly pertinent to the WARD project:

Strategic Objective Three: Developing the potential for long-term increases in productivity.

The basic productive potential of Cape Verde's land is under severe stress, and suffers from yearly soil degradation. The WARD project represents an integrated approach to arresting this decline through closely coordinated investments in adaptive research, extension, and land management which, over the life of the project,

will show measurable returns in reducing yearly damage to soil and water quality. Overall improvement in the productivity of the land will be readily evident through an increase in the percentage of agricultural production that can be attributed to sustainable agricultural practices, and a concomitant decrease in production based on non-sustainable methods.

Strategic Objective Four: Improving food security.

The WARD project addresses food security issues in three important ways. First, improved agronomic practices will result in improved yields. Second, through improvements in agricultural practices and watershed management, the current high variability of agricultural production due to erratic rainfall patterns will be lessened. This will allow for better long-term planning for food imports. Third, this project will support improved long-term programming of food aid revenues in support of economically and technically sound watershed development. This will mean a judicious decline over the life of the project in public funding of workfronts to a more sustainable level, and the concurrent development of alternative employment possibilities for the rural population.

E. Relationship of WARD to Mission Strategy

The current mission strategy has three objectives:

- increase the productivity of the Cape Verdean labor force through aggressive development of a complex of private sector export industries;
- promote private domestic savings for investment and encourage foreign investment in export (foreign-exchange-earning capacity) diversification and expansion; and
- improve the agricultural and natural resource base to maximize agricultural production and enhance the "platform" on which other development activities can occur.

The Export Development Services Project (655-0014) is developing institutional capacity to enhance investment decision-making in foreign-exchange-earning enterprises, thus laying the foundation for improvements in labor opportunities and foreign investment. Mission participation in the regional Training and Human Resources Development Projects aims at improving labor productivity and strengthening institutions in the private and public sectors.

WARD supports the Mission's objectives through its work to enhance the natural resource base and increase agricultural

productivity. It capitalizes on the foundation developed through previous USAID investment in these areas by combining agricultural research, resource stabilization, and technology transfer in order to develop systems that are truly sustainable in the Cape Verdean context.

Provision of technical assistance and training under WARD will lead to more coordinated approaches (agricultural research, extension, soil/water conservation) to watershed development and will encourage the active democratic participation of local populations. Research in water management to maximize agricultural productivity will develop a foundation upon which export opportunities in agriculture can be pursued.

F. Conformity to GOCV Planning and Strategy

In February of 1991, multi-party elections in Cape Verde concluded with the installation of a new majority party (MPD -- Movimento Para Democracia) in the legislature. This sweeping change represents a new direction for the GOCV and the people of this island nation. New policies and programs are being outlined by the GOCV in its 1991-1996 5-year plan (detailed in the Social Soundness Analysis, Annex D.4). Already a new general plan has been articulated and most national goals have been decided. For the first time, regional development goals are also being formulated; they should be completed by January 1992.

The Ministry of Rural Development and Fisheries (MDRP), under which project activities will fall, will be reorganized within the government (see Institutional Analysis, Annex D.5). The MDRP's basic development goals and priorities focus on improving opportunities for rural populations to become more fully engaged in their economic development. In addition to cropping, stockraising, and forestry, the GOCV will emphasize improving market opportunities, promoting agro-enterprises, and developing rural tourism. Specific agricultural objectives of the GOCV include the following:

- protecting land resources (water, land, and vegetation) and reversing degradation and ecological disequilibrium;
- increasing agricultural production through the efficient use of soil and water resources, cropping, stockraising, agroforestry techniques, and extension;
- conducting an inventory of water resources for expanding irrigation;
- improving water management and extending more efficient irrigation techniques;

encouraging more creative use of rural workfronts with the ultimate goal of fostering rural enterprises based on agricultural production.

Cape Verde is endowed with a fragile natural environment. In order to sustain rural production systems, it must continue to devote full attention to the conservation and responsible exploitation of its rural land resources. At the same time, every opportunity to realize the productive capacities of the land must be taken. The WARD project supports the new programs and policies of the GOCV by continuing work on environmental stabilization, promoting efficient use of available resources, and improving the productivity of land.

G. Relationship of WARD to Other Donor Activity

Since independence, donor financing and technical support have been divided among Cape Verde's various islands. As a result, certain islands along with technical areas of intervention have become "reserved" for specific donors. West Germany focuses its assistance on Fogo and Brava, France on São Nicolau, the FAO on portions of Santiago Island and Maio, Switzerland on Boa Vista, and the Netherlands on Santo Antão. While this protocol remains valid today, there are more donors entering the pool. The GOCV would like to have more control in distributing donor financing and activities throughout Cape Verde.

Table 1 in Annex J lists the major donor projects in land and water resources and agriculture for Santiago. There are several reforestation projects in progress, all of which are geographically separated. Livestock needs are being addressed in two projects: the Dutch PVO, NOVIB, is implementing a goat project in arid and semi-arid zones, focusing on nutrition. The upcoming Republic of Cape Verde Community Based Agricultural and Livestock Development Project (referred to hereafter as the 'IFAD project') will be a community-based effort to promote integrated crop and livestock production in two Ribeira Seca sub-watersheds. The project will also introduce technological innovations in family livestock management in rainfed areas and improved range management and livestock production in sylvo-pastoral areas elsewhere on the island.

Several donors, including USAID, are implementing watershed management activities on Santiago Island. Two small projects are being executed, one with Swiss aid and the other with UNSO/UNDP support, on selected watersheds. These projects are not expected to compete for resources with the WARD project, nor does there appear to be an overlap of project objectives or locality.

The IFAD project is potentially the most relevant to activities under WARD. The project has been approved for $7.8 million. France has agreed to provide financing for the technical assistance component. The project will have four major components: 1) development of rainfed agriculture in selected sub-humid zones at the upper reaches of Ribeira Seca, 2) promotion of sylvo-pastoralism in reforested arid and semi-arid zones, 3) creation of farmer and herder organizations, 4) institution of a credit program, and 5) support for participating GOCV institutions in the form of personnel, equipment, staff training, and special studies.

It is anticipated that the WARD and IFAD projects will profit from coordination at some level, especially with respect to technology transfer, extension training, and INIA activities such as sociological surveys and on-farm research. The implementation team should propose a means of maintaining close contact with IFAD project personnel and look for efficient opportunities for collaboration.

II. PROJECT DESCRIPTION

A. Project Goal

The goal of U.S. assistance under the WARD project is to increase sustainable agricultural productivity in Cape Verde and, concomitantly, increase sustainable incomes from these practices. Agricultural productivity is based on irrigated and rainfed crop yields and production of forage, livestock, and forest products.

B. Project Purposes

The purposes of the WARD project are as follows.

- Strengthen the capacity of the General Directorate for Soil and Water Conservation, Forestry, and Rural Engineering (DGCSAFER) to conduct SWC activities, including afforestation programs, but with increased emphasis on: improved structure design, better selection of construction sites, and development of alternative implementation approaches that rely less on traditional public employment schemes.

- Strengthen the capacity of the National Agricultural Research Institute (INIA) in three areas: on-farm research, production systems (including livestock) and water management research, and evaluation/monitoring in both biophysical and socioeconomic spheres.

- Reinforce coordination among GOCV institutions in areas of natural resource and agricultural development and improve the linkage between research and extension.

C. Project Elements

WARD project elements, described below, include a brief overview of the project sites, WARD strategies, expected project outputs, inputs required to achieve these outputs, and the entities responsible for carrying out project activities. WARD is designed on the principle of <u>flexibility</u> in order to allow USAID, the recipient and the GOCV to monitor, assess, and respond to the dynamic and evolving political and institutional developments now taking place, the results of adaptive research, and the body of socioeconomic knowledge that will evolve through a fully developed monitoring and evaluation system.

C1. Project Sites

The Target Watershed

Implementation activities will be organized on the basis of two geographical distinctions: a target watershed and other selected watersheds. The purpose of designating a target watershed is to focus applied research and soil and water conservation in a defined area. This will facilitate interaction among the principle GOCV agencies (INIA and DGCSAFER) and provide a more integrated setting for selected water management studies and for monitoring and evaluating impacts of technologies and practices designed to increase agricultural productivity and sustainability.

Criteria used to select the target watershed stipulated that: 1) a cross-section of major agro-ecological zones be represented, 2) researchers and visitors have ready access to project sites, and 3) there would be no overlap or conflict with other donor-funded projects.

Consultation with Cape Verdean officials, USAID officers, and others resulted in the selection of Ribeira Seca as the project target watershed. Its size (offering every agro-ecological zone available) and proximity to INIA, DGCSAFER, and the Rural Extension Service (DGER) made it an acceptable choice to all parties. In addition, the IFAD project will be implemented in the upper reaches of the watershed, creating possibilities for collaboration between the two projects.

In order to further target land units for research, development, and impact assessment, WARD will concentrate its activities on sub-watersheds within Ribeira Seca. These will be chosen on the basis of site visits, local surveys, and discussions among the implementing agencies, the Consortium, and local inhabitants. They will represent the major agro-ecological zones found on eastern Santiago Island.

Sub-watersheds will be used for several collaborative activities. Baseline socioeconomic and physical survey data will be collected by a detailed study early in project implementation. Additional data and possibilities for on-going people-level impact (PLI) monitoring and farmer feedback will be possible through INIA's Department of Social Sciences and Agricultural Economics (DCSEA). DCSEA is currently conducting studies among 15 representative households over three localities within Rebeira Seca. These are matched to 15 control households in Ribeira São Domingos, where no current development projects are active.

Development activities to be monitored include: on-farm trials of new crop varieties and cropping systems, research and demonstration sites for agroforestry and agrosylvopastoral systems, comprehensive monitoring and evaluation networks for watershed development and people-level impacts, and development of small private enterprises for forestry activities.

Other Project Watersheds

WARD will continue its support to DGCSAFER in soil and water conservation in other Santiago watersheds. As during the WDP, WARD will support, through GOCV-owned PL 480-generated local currencies, construction and maintenance of SWC structures, forestry activities, and RAP extension activities on an additional 11 Santiago watersheds (Cuba, Tarrafal, Principal, São Miguel, Flamengos, Salto, Santa Cruz, Picos, Cumba, Mangue, and Domingos).

WARD will also support selected agricultural research activities outside the target watershed. Varietal trials and on-farm trials will be conducted both within and outside the target watershed depending on specific research goals and crop species.

Project Management Facilities

The two Cape Verdean institutions to receive direct support during WARD are INIA, with offices and facilities at São Jorge, and DGCSAFER, with offices and facilities at Achada São Felipe. INIA will house technical assistance staff and manage agricultural research activities at its facilities at São Jorge. Project housing used by FCRP personnel will be rehabilitated and maintained for technical assistance staff. A guest house will be maintained at São Jorge for use by recurring and short-term TA personnel. Likewise, support to DGCSAFER will be managed from Achada São Felipe. Long-term technical advisors will have permanent office space as needed in these locations. Recurring and short-term personnel will be assigned working space upon arrival. Long-term TA working with DGCSAFER will live in Praia. A small office will be established in Praia for project administration and support and for use by the Project Management Unit (PMU).

C2. WARD Strategies

WARD activities fall into three broad categories: soil and water conservation, forestry, and agricultural research. The primary activities in each area are briefly detailed below. There is embedded overlap, especially in monitoring and evaluation and in the integration of research trials with development activities Sunder SWC and forestry.

SWC and forestry elements are action-oriented and designed to reorient land use and afforestation/revegetation to reflect the need to stabilize soils, diversify the use of tree, shrub, and grass species, and improve the use of existing irrigable land.

The WARD approach will emphasize participation of men and women producers as co-researchers and co-developers, both in on-farm RD&E and in community- or group-level initiatives in which producers suggest or select, negotiate and contract with the project to institute trials, soil and water conservation works, or other local-level activities for which the group agrees to assume subsequent responsibility.

C2.1. Soil and Water Conservation

On-farm Soil and Water Conservation. In a major redefinition of soil and water conservation, WARD considers soil conservation as the design and application of land-use systems that preserve or enhance soil fertility and are at the same time attractive to the user. In a phased expansion that targets Ribeira Seca, WARD will improve extension to promulgate its on-farm land husbandry message. This message is based on contour practices designed to improve soil moisture storage, conserve soils, and improve crop, livestock, and forestry yields. WARD's practices concentrate on encouraging land uses that match land capacities. Its methods include practices such as hedgerow agroforestry, stripcropping with agroforestry species such as *Cajanus*, contour tillage, and planting to optimal densities.

Off-farm Soil and Water Conservation. Structural soil and water conservation practices have been the keystone of Cape Verde's soil and water conservation effort since before its independence. These methods have persisted to today and were a major component of OAR/Cape Verde's previous watershed development projects. While the effectiveness of dams, gully plugs, and drop-inlet spillways to reduce erosion is limited to the area controlled by their reservoir, they do retain sediment, store water and provide employment. Because these structures rapidly fill with sediment, their water storage capacity is essentially that of an upwardly unconfined sand aquifer. Wells in the vicinity of these structures play an important role in meeting domestic water requirements and, during years with adequate rainfall amount and distribution, providing water for irrigation.

Many of DGCSAFER's earlier structures suffer design faults; some of them risk aggravating soil erosion; others risk collapse. Because of this, WARD will rehabilitate and improve existing structures. It will construct a limited number of new ones where a watershed management plan and engineering design show they provide an essential, sustainable benefit. These structures will provide important experience in engineering design according to hydraulic and other specifications.

Development of Irrigable Lands. Preliminary reconnaissance shows that the majority of potentially irrigable land in Ribeira Seca is already developed. During drought years, much of this land is not irrigated because of inadequate water supplies. The underlying basalt over much of the basin is unsuitable for further groundwater exploitation. Channel-bottom alluvium is already exploited to its near maximum by a dense network of hand-dug wells. Downstream well development poses considerable risk of salt water intrusion.

WARD will develop additional, potentially irrigable land in Ribeira Seca in order to demonstrate more appropriate irrigation design for replication elsewhere in Cape Verde. To provide water to these areas, it will construct lined canals, develop springs, wells, or construct diversions across tributary or main channels. The surface area to be developed, the length of canals, and the type and size of other structures, diversions, spring development or wells will be determined during watershed planning and engineering design. WARD will also support research to improve cropping systems management and productivity on existing irrigated land (see Section C).

C2.2. Forestry and Agroforestry

Support to DGCSAFER. WARD will continue to support select activities of DGCSAFER by overseeing tree nurseries, selection and preparation of planting sites, and planting of three million trees in project watersheds. Management responsibilities will be passed on to the Forestry Department during the project on a watershed by watershed basis. This will allow evaluation of institutional capacity while the project is still being implemented. WARD will also improve record keeping and planning within the Forestry Division, drawing first upon successful initiatives under WDP.

Forestry, Agroforestry, and Sylvopastoral Research. WARD will promote collaborative applied research on new tree, shrub, and grass species for use in Cape Verde. Research on forage species for planting in different agroecological zones will be included to foster more efficient use of livestock resources. INIA will conduct socioeconomic prefeasibility studies of proposed fuelwood, secondary tree products, and livestock interventions. On-farm trials will evaluate the appropriateness of promising technologies.

Agroforestry and Sylvopastoral Development. Agroforestry and sylvopastoral development will be promoted by a) developing demonstration sites for promotion in various agro-ecological zones, b) producing and distributing fruit trees and examining micro-enterprise and market-strategy alternatives for fruit and other tree products, and d) working with extension personnel to improve farmer participation and feedback by offering training and risk-minimization incentives if necessary.

Promotion of Private Sector Forestry Activities. A feasibility study will be conducted focusing on private enterprise potential for activities in tree seedling production, tree planting, and fuelwood harvest. In addition, current forest product enterprises will be evaluated in order to develop and promote small enterprises that will increase income to rural families and decrease their dependency on public workfronts for employment.

C2.3. Applied Agricultural Research

WARD supports INIA in three areas: applied research; monitoring and evaluation; and institutional strengthening.

Applied Research.

WARD will assist in building INIA's capacity to conduct applied cropping systems research through selected research activities in the target watershed, well-planned short and long-term training activities, and technical assistance. Specific WARD activities in cropping systems research over the LOP will focus on the following areas:

Water Management Research. More efficient use of water is key to increasing agricultural productivity. Reducing evaporation from soil surfaces, selecting/managing crops to use water more efficiently, and applying water in ways that conserve it should have a significant impact on yield. Examples of research topics in this area include irrigation management, mulching to reduce water loss, water-use efficiency, fertilizer-water response, water harvesting, and alternative water delivery systems.

Cropping Systems. Although water supply is a major factor in crop yields, crop management is the leading cause of inefficiencies in water use, both on rainfed and irrigated fields. On rainfed systems, cropping methods such as contour tilling, hedgerow agroforestry, stripcropping, and terracing can have a major impact in preventing soil loss and increasing productivity. For example, cultivating crops in rows on a contour increases infiltration of rainfall and decreases water and soil losses.

The constraints to introducing such technologies in Cape Verde may be significant. Cropping systems research should be partly based on socioeconomic data on farmer receptivity and through multi-disciplinary, on-farm research. Given Cape Verde's high rainfall variability, its general propensity for drought-related crop failure on rainfed slopes, and the lengthy gestation period required for many agroforestry initiatives, it may take several years to achieve widespread results throughout Santiago Island.

Varietal Improvement. WARD will support adaptive research on varieties of root and tuber crops, forage crops, dryland crops that address soil erosion problems, and irrigated horticultural crops. INIA has some relevant varietal work in progress which can be supported early in implementation. Varietal development will be adaptive, taking advantage of IARC, CRSP, university, and regional plant breeding programs for material to test. Plant selection criteria will focus on drought-tolerant, short growing season varieties. Testing of forage species and crop-shrub-tree combinations for livestock browse and soil conservation will constitute new areas of varietal research for INIA.

Monitoring/Evaluation

WARD will develop INIA's capacity to monitor and evaluate environmental and social impacts of activities aimed at increasing agricultural productivity. Cape Verde needs the capacity to measure and analyze the effectiveness of its conservation and research programs. Without this capacity, planning is grounded on unreliable assumptions and risks wasting scarce resources.

Technical assistance will work with INIA researchers and DGCSAFER personnel to develop a sustainable monitoring and evaluation (M&E) capability. This capability will be housed at INIA where it can profit from existing research facilities. In addition, INIA has the supporting infrastructure (soils and water analysis lab, computer facilities, and a socioeconomics department) necessary for data collection and analysis. Initial activities will include:

a) a comprehensive review of the effectiveness of soil and water conservation structures on Santiago Island;

b) a quantification of impact area and land under cultivation as a result of SWC structures using on-ground survey work and available aerial photography;

c) a measurement of the structural soundness of dams and other structures;

d) analysis of soil evolution and crop yields behind check dams, water table depth and salinity changes; and

e) a socioeconomic baseline study of the target area that captures the start-up status of key indicators of project impacts to be tracked throughout the LOP. This baseline study will be preceded by a thorough review, analysis, and synthesis of existing socioeconomic literature on agricultural families of Santiago.

These data will be used for planning and review of activities. Other activities will be programmed for monitoring and evaluation during project implementation.

Institutional Support to INIA.

On-farm Research Methodology. Training and field implementation in on-farm research methodology and trials is provided in order to strengthen INIA's adaptive approach to research and to support WARD activities in soil and water conservation and agroforestry. On-farm research trials will be conducted, in part, on technical issues related to other project components.

On-farm research also closes the technology transfer gap between research and extension. Rural extension agents will be trained in on-farm methodology and be active participants in farmer group selection, conducting of field trials, and dissemination of results through demonstrations and other extension means.

Research Management. A modest amount of technical assistance and training will be furnished on specific topics of research management and administration, including proposal writing, research priority setting, record-keeping, and administration. Institutional changes planned by the GOCV may augment the importance of management training in the areas of contracting and personnel management. Should these become priority areas, appropriate TA and training will be programmed.

C3. Project Outputs

WARD project outputs are a combination of tangible, physical objects produced with project resources and strengthening of institutions.

OUTPUT 1 Soil and Water Conservation Structures and Technologies

1A. On-farm soil and water conservation. Participating farmers will collaborate with INIA, DGCSAFER and DGER to implement improved upland farming methods -- hedgerow agroforestry, agroforestry stripcropping, contour tillage, seeding to optimal densities -- on 1,000 hectares of rainfed land in Ribeira Seca. This figure assumes that, at the EOP, approximately one-third of R. Seca's farmers will have treated 100 percent of their land.

1B. Off-farm soil and water conservation. In Ribeira Seca and other watersheds, using workfront labor, DGCSAFER will design and construct a limited number of drop-inlet spillways on tributary channels and a lesser number of cross-channel spillways on principal waterways. It will upgrade, rehabilitate, and maintain structures showing important design faults or in danger of collapse. The exact number and type of structure will depend on

watershed plans, engineering design, and other analyses. For rough estimation purposes we estimate WARD will construct a total of 330 tributary channel and 25 main channel structures. About 40 principal structures require varying degrees of rehabilitation; many others require maintenance. An important output is hands-on experience in structural design according to hydraulic and other specifications.

1C. Development of irrigable lands. In Ribeira Seca DGCSAFER will construct lined canals, develop wells and build diversions or other structures required to link land to water source. The purpose of this activity is to provide hands-on training and demonstrate appropriate irrigation design and management for replication in other watersheds. For estimation purposes an additional nine hectares of land can be developed for irrigation. This will require about 10 km of canal and at least three diversions, spring developments, or wells. These works will be financed by the government using local currency generated through the PL 480 Title II program. Individual farmers and landowners are expected to bear the cost of developing the irrigated land. Watershed and engineering design plans will determine the exact number and size of structures required.

OUTPUT 2 Afforestation and Agroforestry in Selected Watersheds

2A. Afforestation of environmentally fragile land using three million trees. With use of workfront labor, appropriate tree species will be planted in each of the project watersheds on the basis of available land and agro-ecological zone. Planting sites will be prepared according to successful methods utilized under the WDP. Afforestation and reforestation activities will result in significant, measurable increases in fuelwood. WARD will also produce and distribute 30,000 fruit tree seedlings.

2B. Introduction and testing of twenty tree, shrub, and grass species. DGCSAFER and INIA will collaborate to select plant material adapted to Cape Verde's agro-ecological zones and socioeconomic needs. Material will be tested either in small plantations and test plots. Appropriate agroforestry species will be tested in on-farm trials led by INIA. Plant diversity will be increased by introduction of successful new species or varieties with the goal of reducing planting of *Prosopis juliflora* and *Acacia holosericea* by 30%.

2C. Implement agroforestry and/or improved cropping systems on 1,000 hectares of rainfed land. (This corresponds to the 1000 hectares to be treated as an output in the preceding section on soil and water conservation.) DGCSAFER will collaborate with INIA and DGER to demonstrate agroforestry and pastoral management on six demonstration sites.

OUTPUT 3 Strengthened Applied Research Capacity of INIA

3A. Developed applied research capacity in INIA in the technical areas of cropping systems research, water management, and varietal improvement using on-farm research methodology. Increased capacity to conduct on-farm research through a series of four short courses (FSR Methodology, Socio-Economic Field Methodology, On-farm Research, Experimental Design/Statistics) and eleven on-farm trials planned, conducted, and analyzed with results leading to formulation of extension materials or further research.

3B. Improved research planning and administration in INIA. INIA will be strengthened in the areas of setting research priorities, streamlining management processes, developing proposals for outside funding, and monitoring and integrating research activities.

3C. Improved technology transfer through strengthened research-extension linkages. Rural extension agents will participate with researchers in on-farm trials. INIA and DGER will develop extension materials (fiche techniques, videos, etc.)

OUTPUT 4 Monitoring and Evaluation System

4A. Monitoring and evaluation system. A monitoring and evaluation system will be created within INIA, focusing initially on review and assessment of past SWC structure development and impact.

OUTPUT 5 Human Resource Development

5A. Nine candidates trained in fields related to soil and water conservation, applied research, and agroforestry. Training will be planned and provided at the Bachelor's level for three Cape Verdeans and at the Master's level for six Cape Verdeans at U.S. universities.

5B. Thirty candidates trained in-country for GOCV technician and extension agent positions. Graduates will fill vacancies and additional staff requirements for INIA, DGER, as well as other GOCV agencies. Extension and INIA technician graduates will do one-year rotations in each institute before being permanently assigned.

C4. Project Inputs

The project inputs detailed below represent the resources needed to generate the project outputs. Funding and support is derived from three sources: the Development Fund for Africa will contribute $9.0 million in grant funds over a seven-year implementation period (FY92-FY99); monetization of commodities from a PVO-managed PL 480 Title II food program will provide $8.4 million of GOCV-owned local currency genrations over the LOP; and, in-kind inputs provided by the GOCV will total approximately $1.4 million in salaries, facilities, and support.

C4.1 Development Fund for Africa

Technical Assistance

WARD will capitalize on the use of three modes of technical assistance: long-term, recurring, and short-term. The technical specialties required and length of service necessary to conform to project objectives is based on the technical and social analyses conducted during the course of PP design. The design team is aware of the need for flexibility as the situation and input requirements change. See Chapter IV.A, WARD Programming Flexibility.

The philosophy underlying the use of technical assistance in the WARD project is based on shared learning and a cooperative, multidisciplinary approach to problem solving. Long-term technical assistance has been limited to what is necessary to assure continuity and coordination among agencies and participants. The primary role of long-term personnel, aside from their technical input, will be to manage the project implementation process and orchestrate the efficient use of other project inputs.

Long-term Technical Assistance

Long-term technical assistance will consist of three positions: a watershed management specialist, a rural sociologist or agricultural economist, and an agronomist experienced in water management.

Watershed Management Specialist/Team Leader. A watershed management specialist will serve as a long-term technical advisor and team leader to WARD for six and one half years of the project. This person will be charged with coordinating support to DGCSAFER and providing oversight to continuing project efforts in soil and water conservation. Qualifications important to this assignment are: broad experience in watershed and natural resources management in semiarid zones; knowledge of hydrology and hydraulic engineering; and fluency in Portuguese. Specific tasks to be performed by the long-term watershed management specialist include:

1. Management and technical oversight of continuing rural engineering and afforestation work conducted in project watersheds.

2. Facilitate the smooth transfer of above responsibilities to Cape Verdean counterparts on a watershed by watershed basis.

3. Represent WARD in collaborative efforts to establish and manage a watershed evaluation and monitoring program.

4. Coordinate planning and implementation of research in forestry, agroforestry, and sylvopastoral systems. Interface among short-term specialists, INIA researchers, and DGCSAFER counterparts.

5. Provide leadership to short-term TA, extension agents, and DGCSAFER field personnel in the promotion of agroforestry and improved pasture systems.

6. Develop terms of reference and provide orientation to all short-term TA working in watershed development components.

7. Take major responsibility for fulfilling all regular reporting requirements of the project, as well as for reporting the results of socioeconomic research.

Anthropologist/Rural Sociologist/Socioeconomist. An experienced social scientist will provide long-term technical assistance for two years. Qualifications critical for this assignment are: strong background in both large- and small-scale survey techniques and quantitative and qualitative field methods; familiarity with basic agricultural economics; computer literacy and expertise in standard statistical packages for data analysis; demonstrated experience on farming systems research and extension (FSR&E) field teams; fluency in Portuguese; and good writing skills. Specific responsibilities of this individual include the following.

1. Institute and supervise maintenance of a monitoring system to track and analyze cumulative "people-level" and related impacts and outputs of WARD, beginning with a thorough review of data and literature currently available on socioeconomic and agroecological parameters of farming systems in the project area.

2. Support and give continuing on-the-job training to INIA's socioeconomics department (DCSEA) in applied, problem-solving research design, efficient field methodologies, on-going monitoring and evaluation, and data analysis.

3. Facilitate and coordinate linkages, data analysis, and collaborative on-farm research activities within all project components and between the project and extension entities plus other relevant donor projects (e.g. IFAD).

4. Design and implement/oversee specific socioeconomic and producer opinion studies of topics required to advance the work of other project components by increasing the knowledge base of, for example: farm- and community-level social, cultural, and economic organization; potential project innovations in crop, livestock, forestry, SWC, etc. technologies or practices; microenterprises and product marketing feasibility.

5. Assume responsibility for project reports related to results of socioeconomic data collection and PLI's.

Agronomist. The project Agronomist will work with INIA for five and one half years of the project to develop applied research programs in the areas of water management, cropping systems research, and on-farm research. His/her expertise will be in the area of cropping systems, water management, or irrigation. Other qualifications expected for this position include: broad experience in research methods, statistical analysis, and design of field experiments; experience in advising or supervising young research staff; good writing skills and reporting habits; and fluency in Portuguese. Specific responsibilities of the agronomist include:

1. Support the President and Research Director of INIA in the areas of research planning, coordination, and research staff supervision.

2. Support INIA research programs through advice and training in the areas of cropping systems, agricultural water management, irrigation, and varietal improvement.

3. Coordinate and supervise recurring and short-term technical assistance including developing terms of reference, and providing arrangements for logistical support.

4. Design and implement research in water management, water-use efficiency, and cropping systems research.

5. Develop linkage with the DGER on extension training, participation in on-farm research trials, and development of extension materials.

6. Assist in the development of training plans for long-term training candidates and tracking progress of candidates in training. Advice on training locations and core subject areas.

There is some overlap in duties among the three positions. This reflects, in part, the breadth of activities each advisor will become involved in. As all three positions are not in the same institute and do not always overlap during the project, it is important that each have experience and skills commensurate with that of a project team leader.

Recurring Technical Assistance

Recurring technical assistance is support provided by individuals who make repeated visits, on an as needed basis, to work on selected topics or with individual GOCV counterparts throughout project implementation. The concept of recurring technical assistance works particularly well with research, and has been proven effective in AID's Collaborative Research Support Programs (CRSPs) world-wide. Recurring technical assistance comprises a key TA component for the WARD project. WARD will benefit from a variety of technical specialties to conduct in-country training courses, advise research and conservation personnel on specific project-related activities, provide field-level instruction and supervision, assist in management of project studies, and perform other services.

A last minute meeting with INIA emphasized their strong felt need for an irrigation agronomist/engineer, and pointed to the need for this specialist for an extended period in year one of the project. The design team suggests that additional person months be allotted for this position (ten months were programmed -- see Table 2, Annex J) and that a suitable candidate be fielded during the first nine to eleven months of the project and thereafter as required.

Each recurring TA will be required to leave a report detailing how his/her services were used, tasks accomplished, and specific recommendations for future activities. During the first visit in-country, recurring TA will develop a tentative workplan for remaining years of the project. An illustrative list of anticipated recurring and short-term TA requirements are provided in Table 2, Annex J.

Short-term Technical Assistance

Short-term technical assistance under WARD will be limited to special topics and services that are not likely to be repeated during the LOP. Subject areas that short-term TA will address include agricultural statistics, engineering, computer training, soil analysis, and participant training. WARD also plans to utilize short-term local hire consultants as well.

Training

Training details for the project are outlined in the training plan, Section III-B. Under WARD, nine long-term degree candidates will be trained. Candidates from INIA will receive degree training in selected areas such as watershed management (with coursework in natural resource management), agroforestry (research), agricultural economics, water or irrigation management, and hydrology. The Forestry Department of DGCSAFER will nominate two candidates for degree training in agroforestry/social forestry and range management.

Commodity Procurement

Commodities required for project implementation include project vehicles and spare parts, construction materials for SWC structures, research and lab equipment, office supplies, and other items. Procurement of these commodities will be predominantly off-shore since few are available in-country. Some project vehicles with spare parts and other minor items will be obtained by OAR/Cape Verde using AID Direct Procurement procedures. Priority items can be ordered by the project manager even before the arrival of the TA team. A contract for housing rehabilitation might be let on a similar basis. All other procurement will be the responsibility of the Consortium. Details on local and offshore commodity procurement are provided in Section III-C.

C5. PL 480 Food Programming

Background

The GOCV has requested and received food aid assistance from the U.S. since 1977. Until 1986, food aid was administered as emergency aid under U.S. Public Law 480 (PL 480), Title II, Section 201 in order to meet "famine or other urgent or extraordinary relief requirements." Normally, no less than 50% of food imports under this section are to be distributed directly to consumers. However, with U.S. agreement the GOCV has generally monetized all U.S. food aid imports to "avoid creating a welfare mentality" and instead pay wages to workfronts from the generation of local currency.

Primary imports under Title II have been corn, rice, and vegetable oil. Corn has by far comprised the bulk of imports. From 1977-82, total value including transport of food aid was $23.2 million. In 1984 and 1986, a total of $2.3 million in pinto and navy beans was also included in emergency food aid.

After 1986, food aid to Cape Verde was restructured under PL 480, Section 206. This allowed food aid to be programmed over longer time periods. Imported commodities were provided as a grant

to the GOCV which, in turn, would set aside all proceeds, less handling costs, for development-type activities leading to a reduced food deficit and rural economic development. Most of these funds were used in recent years to pay workfronts engaged in construction of SWC structures and/or afforestation. The Section 206 program continued up through FY90. Under the PL 480 legislation recently enacted, Cape Verde no longer qualifies for government to government food aid on a grant basis (Title III under the new act). For FY91, a one-year food program under Section 416 is being used to import 18,000 MT of corn.

Commodity imports vary yearly according to results of a food needs assessment. This assessment is conducted by USAID in the first quarter of each year and is based largely on production data. An average of 15,000 MT of #2 yellow corn per year has formed the basis of the Section 206 program.

Since Cape Verde no longer qualifies for a government to government food aid grant under the new food aid legislation (the 1990 Farm Bill), another instrument has been sought for programming food aid. Section 416, although used in FY91, is not the preferred instrument for long-term programming. Food aid under Section 416 is based on US surplus stocks and, as such, is subject to changes in commodity availability each year. Application for Section 416 must be made each year, requiring high Mission overhead and yearly agreements on transport costs. Starting in FY92, food aid programming for Cape Verde will be administered under a PVO-managed Title II monetization program.

PL 480 Programming under WARD

PL 480 generated local currencies will continue to be used for project-related activities, but will be significantly reduced over the life of project. Activities considered part of the WARD project, and which will be funded from PL 480 local currencies, include the following:

- Payments to workfronts for the construction and maintenance of SWC structures and for activities in afforestation/revegetation. Approximately 97,000 person months of workfront labor will be generated by the project. Payments to workfront labor will total approximately $7 million over the life of project. Workfront activities will include: structure maintenance; new construction; tree, shrub, and grass planting; and nursery operations. Although WARD will utilize only about one million dollars for workfront labor in 1992, it is assumed that previous mechanisms and carryover funds will be utilized to continue work in progress for the first six months of 1992 until WARD watershed construction and forestry activities can begin.

- Payment to RAP personnel for organization and management of community workfronts and other community-based programs.

- Payment of local costs for in-country training programs conducted at the National Training Center.

- Local research support costs: hiring temporary field labor, rural survey workers, and purchase of local materials.

- Other local costs such as income guarantees to farmers participating in on-farm research trials.

Under the multi-year PVO Title II monetization program, the bulk of the PL 480 local currency generations will be jointly programmed in support of WARD activities. These local currencies will be deposited in two separate accounts and will be considered GOCV-owned local currencies. One account will be set up for use by DGCSAFER for soil and water conservation construction and afforestation activities and RAP personnel. The other account will be set up for use by INIA to support in-country training, and research and extension activities undertaken by the WARD project. These accounts will be jointly managed by the GOCV and the recipient. Disbursement of funds will not be made out of these two bank accounts until the accounting system and internal control procedures assessment have been satisfactorily completed and approved by the Regional Controller, REDSO/WCA.

Sustainability of Workfront Activity

Under WARD, project programming of workfront activities will total approximately 40% of the level of effort of similar activities under the WDP project. This decreased programming of PL 480 funded activities represents a GOCV and USAID commitment to decrease project-related employment generation. It is increasingly evident that rural workfront labor support is unsustainable at current levels, and that Cape Verde can no longer afford to build structures that do not significantly contribute to SWC objectives. The GOCV is firmly committed to exploring alternative income-generating activities for rural workers and gradually reduce workfront support to a more sustainable level. Other workfront activity, such as road construction, road and structure maintenance, and school/clinic construction, may be programmed by the GOCV to replace the expected reduction of SWC construction, but these activities would fall outside the purview of WARD.

PL 480 Management

A multi-year PL 480 Title II monetization program has been submitted by a US PVO, and it is anticipated that this program will be approved to begin in FY 1992. The proposed program is to be appropriately integrated with the WARD project design, including the programming of the bulk of local currency generations in support of WARD activities. In addition, it is anticipated that this PVO will also use some local currencies to support and promote local, family and cooperative development and work with other Cape Verdean NGOs to develop pilot and experimental projects in soil and water conservation and related areas.

Although this multi-year PVO Title II monetization program is not yet approved, OAR/Cape Verde is confident that this program will be approved shortly and that it will program the bulk of the local currencies in accordance with the WARD project schedule of activities. In the event of a delay in the approval of a PVO Title II monetization program, OAR/Praia is committed to request for food aid to be monetized under either a Section 416(b) or Title II emergency program to help meet the structural food deficit in Cape Verde.

It is anticipated that the PL 480 program will generate funds in excess of the local currency needs of the WARD project and food aid administrative costs (based on a yearly food aid allocation of $2,000,000). The PVO implementing the food aid program is expected to use these excess resources, to the extent possible, to fund activities that demonstrate alternative approaches to rural employment that rely on private rather than public initiative. Of particular interest to OAR/Cape Verde and the GOCV is development of alternatives to public workfronts for the development and maintenance of rural watershed structures. Since these pilot activities will be carried out by the PVO under its own authority, they are not defined as part of the WARD project; rather these PVO activities will complement the project and address concerns raised at both REDSO and AID/W reviews that sustainable employment alternatives to rural workfronts be sought by OAR/Cape Verde.

The PVO, as the PL 480 management entity, will also be responsible for other management aspects of the food aid program, including fulfilling reporting requirements, organizing PL 480 evaluations, and ensuring timely payment to workfront labor.

C6. GOCV Inputs

The Government of Cape Verde will support the WARD project by financing the salaries and benefits of INIA and DGCSAFER staff working on the project. Office space at São Jorge and Achada São Felipe, and housing at São Jorge will also be provided for the project team. This contribution is estimated at $1.4 million over the life of project.

In addition, the GOCV will utilize approximately $8.4 Million of PL 480 local currency generations in support of WARD activities. The GC has recognized that host country owned local currencies (including PL 480) can be used by the host country to fulfill the 25% host country contribution requirement. Thus, the 25% host country contribution is easily met through the contribution of approximately $1.4 Million describe above along with the programming of $8.4 Million of PL 480 local currency generations in support of WARD activities.

D. Beneficiaries

As noted in earlier sections, WARD will be implemented in 12 watersheds on Santiago Island's eastern, windward coast. One watershed (Ribeira Seca) will serve as a target site for on-farm research and for experiments in new, integrated systems of soil and water conservation (SWC) and agrosylvopastoralism.

Throughout the project area as a whole, members of workfronts constitute the most direct and immediate beneficiaries of WARD. Moreover, preference in workfront employment is given to the most needy rural families. Across the LOP, a total of U.S. $7.2 million is programmed for workfront salaries. This translates into employment for approximately 1800 individuals annually, assuming a work season of 10 26-day months and the rule of one employee per family. Calculated at a family size of 5.7, this means that 10,280 rural Santiagoans annually will benefit from an average workfront income of $600 (calculated at a mean of 170 escudos per day X 260 days at present rates of approximately 75 escudos to U.S. $1.00). In reality, however, many more families are likely to benefit. Individuals from different families may be employed from year to year, and in some years, tasks, or areas, only a six to eight month work season is required. These factors would promote a much broader distribution of earnings.

Wherever possible, WARD will give preference in hiring to the community-based workfronts (CBWFs) organized under the Rural Assistance Program (RAP) of Cape Verde's previous project in watershed development, rather than the so-called "classical," state-organized workfronts. CBWFs offer benefits beyond merely subsistence salaries. They are designed to promote not only infrastructural but also human development. This is encouraged through a variety of means: worker participation in choice of subprojects and elaboration of workplans and schedules; siting of subprojects so that their benefits redound to the land that CBWF members themselves work; democratic election of crew leaders; training of workers in technical aspects of SWC-related measures (e.g. nursery management), election procedures, and leadership and administration skills; support for community self-help initiatives (e.g. construction of wells, canals, community centers); and in general, strengthening of community solidarity to maintain gains in

SWC and other improvements and to assume greater responsibility for self-development. WARD will continue this tradition, but with the goal of moving CWBFs toward independence by emphasizing income- and yield-increasing alternatives in agrosylvopastoralism that households and inter-household or community groups can themselves organize and sustain.

The 12,250 men and women producers in the target watershed and their families will be the first to benefit from these alternatives since they will be recruited as co-researchers and co-developers in WARD studies and on-farm trials to elaborate more productive, cost-effective, and locally "do-able" SWC and farming strategies. Recruitment will be voluntary and risk-sharing arrangements between producers and the project will be made where appropriate.

As throughout Cape Verde, producers in Ribeira Seca can be categorized in a variety of cross-cutting ways. One is by ecozone: humid, subhumid, semiarid, arid. Another is by general farming system -- i.e. rainfed, irrigated, or mixed rainfed/irrigated -- with all three typically including stockraising. Another is by household headship, i.e. a male-female pair or a female only. While WARD will address all these producer groups, it will pay special attention to female-headed households given that they comprise 40% of all rural families on Santiago. Moreover, they are confronted with a distinct set of farming-system constraints.

As workfront dependency is phased down and WARD SWC and farming systems interventions are tested and phased in, tangible benefits to Ribeira Seca producers will include, but not be limited to: increased diversity within a farming system and thus decreased risk; higher farm yields, e.g. of staple foodstuffs, vegetables, meat, dairy items, fruit, fuelwood, forage, fodder; related to both the foregoing, better balance in family diets; augmented, stabilized, and/or more independent household income flows resulting from increased sales of and/or decreased expenditures on purchase of such products; and possibly further earnings from related microenterprises (e.g seedling sales, cheese-making) piloted or improved and expanded under PVO auspices.

Additional secondary, intangible, or subjective benefits can also be anticipated for agricultural families and communities in the target watershed. More difficult to predict or quantify, however, these may include: a greater sense of self-determination, choice, and control on the part of individuals or groups; generally expanded SWC and agrosylvopastoral knowledge and skills; improved quality of homelife due to less need for fathers to emigrate or for children to work so as to secure family survival; and enhanced communication and mutual appreciation between producers and research and extension services.

Economic and dietary benefits will also accrue to rural and urban consumers over the longer term. Lower class and poor consumers in particular can take advantage of the cheaper food prices that typically result from higher yields and/or lower production costs. New crop varieties and species may place a greater range of healthful foods on the market. Expanded irrigation and improved SWC, cropping, and stockraising techniques may remove some seasonal constraints on the availability of nutritious foodstuffs such as vegetables and fruits.

Over the longer term of the seven year LOP and depending upon the strengthening of extension systems in Santiago, producers and consumers in the other 11 project watersheds stand to reap the same benefits as those detailed above. The environmental and especially the sociceconomic situations in these 11 watersheds reportedly differ little from Ribeira Seca's. Thus there should be few barriers to extension of WARD accomplishments to these areas. At a conservative estimate, this beneficiary group totals 45,000 individuals or some 9000 families. In the longer term still, inhabitants of other watersheds of Cape Verde will benefit insofar as WARD strengthens the capacity of Cape Verdean scientists, extensionists, and institutions to modify and diffuse technologies, practices, and socio-organizational strategies.

To promote this longer-term goal, WARD will fund a variety of training opportunities for several further groups of beneficiaries. Selected RAP personnel will be offered advanced instruction in extension skills, as will also DGER extensionists. And a broad range of researchers and technicians in each of the Cape Verdean institutions involved in WARD will benefit from various levels of training programs (see Section III.B for details).

III. IMPLEMENTATION PLAN

A. Schedule of Activities

The following is a schedule of the major activities in implementing the WARD project during the first three years. Details on short-term/recurring technical assistance can be shown only for 1991-92, since the Consortium and GOCV counterpart agencies will propose a life-of-project detailed schedule for all technical assistance as part of its work plans. They may also propose other modifications to the following schedule.

Activity	Projected Date
1991	
Sign project agreement	Sept. 1991
Issue PIO/T for Project Manager	Oct. 1991
Submission of PVO Title II Monetization Proposal	Oct. 1991
Coordinating Council established	Nov. 1991
Issue PIO/T for Coop. Agreement	Nov. 1991
Approval of PVO Title II Monetization Proposal	Dec. 1991
Issue RFA for main cooperative agreement	Dec. 1991
Initiate direct procurement of some vehicles/miscellaneous items	Dec. 1991
Project Manager PSC begins work	Dec. 1991
1992	
Preselection of 2-3 long-term trainees	Jan. 1992
Review proposals for main cooperative agreement	Feb./Mar 1992
Staff housing readied	Feb. 1992
Sign cooperative agreement	Apr. 1992
Arrival of Watershed Specialist/Team Leader, Sociologist (long-term TA)	Aug. 1992
Initiate Baseline studies	Aug. 1992

Short-term training specialist assesses training needs	Aug.	1992
Consortium initiates commodity procurement	Sept.	1992
Initiate WARD SWC construction/afforestation activities	Oct.	1992
Detailed implementation workplan approved by Coordinating Council	Oct.	1992
Short-term TA in land use, soil erosion, and extension develop baseline data	Sept.- Dec.	1992
Detailed training plan approved by Coordinating Council	Dec.	1992
Construct experimental run-off parcels	Dec.	1992
1993		
First training provided for extension workers	Jan.	1993
Select 3-4 long-term trainees	Jan.	1993
Arrival of Agronomist (long-term TA)	Mar.	1993
First demonstration irrigation sites selected	Apr.	1993
First project evaluation	Aug.	1993

B. Training Plan

Introduction

In addition to continued support to INIA and DGCSAFER of activities in agricultural research and watershed development, WARD proposes a new set of diverse activities that will require the involvement of professionals in a variety of technical disciplines. WARD will initiate on-farm research, agroforestry and sylvopastoral management, and watershed monitoring; activities requiring some professional capabilities currently unavailable within the participating Cape Verdean institutions.

It is the task of both the Project Paper design team and the implementing Consortium to identify skill gaps in these institutions and to develop a training plan, including long-term degree training, third-country and in-country short-courses, on-the-job training and workshops, to complete the educational development of INIA and DGCSAFER personnel to meet the needs of all WARD activities.

Training Planning and Management

Long- and short-term training needs identified during Project Paper Design are shown in Tables 3 and 4, Annex J. Refinement and modification will be the responsibility of the Consortium and counterpart agencies. Early in the project, the WARD Training Specialist, in consultation with heads of counterpart agencies, will conduct a thorough training needs assessment, analyze in-country training facilities, programs, and human resources, and create a global training plan related to the objectives of the WARD project.

REDSO/HRDO will provide technical assistance and guidance for the development and implementation of the training plan. REDSO/HRD will also assist OAR/Praia with the monitoring of the recipient to ensure compliance with A.I.D. training regulations and requirements.

For overall management of WARD training, a Training Committee will be formed of project long-term TA, the USAID Project Manager and representatives from participating Cape Verdean institutions. With oversight provided by the WARD Training Committee, the project will develop annual training plans for scheduling activities, assigning responsibilities, and defining budgets.

Long-term Training

WARD will sponsor Cape Verdeans in six Master's degree and three Bachelor's degree training programs at selected American universities. Most degree programs will be initiated in the first two years of the project in order to allow participants several productive years working with American counterparts upon return to Cape Verde. The WARD Training Committee will have ultimate responsibility for participant selection for long-term degree programs. The committee will review biographical data of proposed students, the needs and priorities of the employing institutions, and strengths and weaknesses of the universities being proposed. Student selection criteria will include but not be limited to: GOCV priorities (including Minister of Education clearance), USAID priorities, applicant's job performance, and applicant's language capabilities.

This committee also will take an active role in closely tailoring academic programs and thesis topics to each participant's personal needs and job responsibilities. This will be achieved through communication with and (when feasible) field visits by the students' graduate advisors/major professors. Active participation of graduate advisors in project research activities will be promoted and supported by WARD. This approach will help assure an academic program relevant to the situation in the field.

Student progress will be monitored most intimately by the student's major advisor and/or committee chairperson. A Consortium representative officed in the United States will provide the communications link between student advisors and project managers in Cape Verde. At six month intervals, this representative will produce progress reports on all long-term trainees. When appropriate, he/she will also facilitate attendance in summer or mid-winter seminars or short-courses at other institutions.

Thirty students will attend a two-year course held at the National Training Center in São Jorge. This training is part of the regular curriculum of the Center and is designed for mid-level technicians for employment within the MDRP. In addition to the normal curriculum, additional coursework in on-farm research, survey and reconnaissance methods, and other special topics will be programmed.

Criteria for selection of universities or other American training institutions to host WARD long- or short-term trainees will include: program relevance to the participant's job description, flexibility to custom-design study program to specific participant needs, similarity of ecology and climate of the institution's locale with Cape Verde, faculty experience internationally, and the institution's experience in hosting international students.

Short-term Training

Short-term training with WARD will be diverse both in program content and target audience. The project will seek to upgrade the skills and knowledge of participants including INIA researchers and staff, forestry and rural engineering management personnel, field technicians, extension agents, collaborating farmers, and community groups. While opportunities for relevant training programs will be explored in the U.S. and third countries, the majority of short-term training will be conducted in-country.

The selection process for participants in short-term programs will differ based on the type of audience targeted. For training designed to address specific research or technical needs (e.g. training in socio-economic survey methods), the proper individual to receive the training might be obvious. In other cases, such as the selection of forestry technicians to participate in a short-course on agroforestry methods, WARD long-term TA and supervisors and advisors with the DGCSAFER would reach a consensus based on geographic distribution of the agents, job performance and level of interest, and financial resources available. For other types of training, such as workshops for RAP extensionists or cooperating farmers, the audience may be small enough to allow everybody to participate. In all cases, WARD annual training plans will consider scheduling carefully so as not to conflict with key project activities or, in the case of producers, with critical

points in the agricultural cycle.

Opportunities for short-term training in topics not covered in programs held in Cape Verde will be explored in the United States and in third-countries such as Portugal, Senegal, and Brazil. More frequently however, short-term training will take place "on-the-job" or be held at the National Training Center in São Jorge. Besides offering the regular post-secondary curricula for mid-level technicians destined to work for the MDRP, this center hosts short-courses and workshops managed and financed by other institutions or projects such as WARD. In addition, WARD may sponsor participants in courses offered by other programs. For example, the FAO/Belgium Forestry Project offers a variety of courses including: Training of Trainers, Extension Methods, Sylvopastoralism, Forest Law, and Community Forestry. To the extent possible, WARD will employ local trainers, training managers, and support personnel. Substantial field work/study will be included in all shortcourses. Each training program will conclude with a debriefing/evaluation where participants can assess their own progress, evaluate the appropriateness of course content, quality of trainers employed, etc., and make recommendations on improvements needed in course content and teaching methods.

C. Procurement Plan and Methods of Financing

Overview

The WARD project is being financed from three sources of funds: DFA funds, local currency generations from a PVO Title II monetization program, and GOCV funds for salaries and in kind contributions. DFA funds, totaling $9,000,000 (48 per cent of total project cost), will be used to obtain necessary project inputs in support of the Cape Verde Watershed and Applied Research

Development (WARD) activities, outputs, and purposes, including the provision of technical assistance, training, commodity procurement, evaluation and audit services, and project management.

GOCV contributions, in the form of PL 480 local currency generations from a PVO Title II monetization program totaling approximately $8,443,000 (45 per cent of total project costs), will be utilized for the construction of soil and water conservation structures and afforestation activities, in-country training, research, extension and training support. Additional GOCV contributions, totaling approximately $1,400,000 (7 per cent of total project cost) will be used for salaries of GOCV personnel and in kind costs (office space, etc.).

All procurement funded from DFA funds will be conducted following the procurement guidelines for activities financed under the DFA. The project will utilize to the extent practicable goods and

services of U.S. origin and from U.S. sources. It is anticipated that all of the long-term technical assistance will be of U.S. origin. Most other forms of technical assistance are also expected to come from the U.S., except for locally recruited consultants.

All vehicles will be procured from the U.S. Long-term participant training will be undertaken in the U.S. Other training programs will be at local or regional training institutions or in other developing countries. Services and commodities procured by non-governmental organizations under their respective cooperative agreements will be of U.S. source and origin, with the possible exception of special training material which may need to be purchased from other free world country sources (Code 935). OAR/Cape Verde with the assistance of A.I.D./Washington's office of transportation (SER/OP/TRANS) will make every effort to ensure that commodities procured directly by A.I.D. or the A.I.D. contractors will be shipped on U.S. flag carriers in compliance with the U.S. cargo preference act. The OAR/Cape Verde project manager will maintain records on all project procurement by A.I.D. geographical code and will report this information annually to AID/W's Africa Bureau.

Procurement of Technical Services

In order to reduce the management burden on the two USDH OAR, a condition imposed by AID/W during the FY 88 ABS review, OAR is proposing that the WARD project be implemented by a PVO and/or University. PVOs have demonstrated a capacity to implement natural resource management activities in Africa and elsewhere and using a PVO would be responsive to mandates expanding the role of PVOs in AID programming. However, because only a limited number of PVOs have experience in coordinating agricultural research, a major part of the project, OAR concluded that entities best qualified to conduct the research activities are experienced Title XII institutions. Thus, OAR is recommending that implementation of WARD be carried out by PVOs and/or Universities.

Since the definition of the problem and the approach to WARD was developed in Cape Verde through past experience and interaction between the GOCV and OAR, any implementation by a PVO would have to respect the realities and parameters of undertaking development activities in Cape Verde. Therefore, OAR believes that a cooperative agreement is more appropriate than a grant because it provides for the substantial involvement by OAR at various stages in the program being funded (defining problems, approach and measuring progress in achieving objectives).

It is anticipated that nearly all of the DFA-funded components of this project will be implemented through a cooperative agreement with a PVO and/or University, except for the contracting of a PSC Project Manager, which will be contracted for directly by OAR/Cape

Verde. The recipient(s) of the cooperative agreement will be selected through the evaluation of the Request for Applications (RFAs) submitted by interested PVOs and/or Universities. The RFA will be synopsized in the Commerce Business Daily and applicants are to be limited to PVOs, Cooperative Development Organizations and Universities. After review by the technical selection committee, OAR will request that RCO/Dakar negotiate and execute the cooperative agreement with the top-ranked applicant. A PVO will also be implementing a multi-year Title II monetization program, with the bulk of the local currency generations programmed between the GOCV and the PVO for the implementation of WARD project activities. The recipient of the cooperative agreement will provide the following technical assistance:

Long-term Technical Assistance	Length of Service
1. Watershed Mgmt. Specialist	78 pm
2. Agronomist	66 pm
3. Anthropologist/Rural Sociologist	24 pm
Anticipated Recurring Technical Assistance	
1. Agro-forester	5.5 pm
2. Range/Livestock Specialist	4.5 pm
3. Private Enterprise Specialist	4.0 pm
4. Fruit Production Specialist	4.5 pm
5. Hydrologist (Monitoring)	9.0 pm
6. Watershed Agronomist	3.0 pm
7. Soil Erosion Specialist	5.0 pm
8. Irrigation Specialist	10.0 pm
9. Extension Specialist	8.0 pm
10. Research Planner	5.0 pm
11. Farming Systems Researcher	4.0 pm
Anticipated Short-term Technical Assistance	
1. Training Specialist	1.5 pm
2. Tree Seed Specialist	1.5 pm
3. Tree Legume Specialist	1.5 pm
4. Forage Specialist	2.0 pm
5. Animal Nutritionist	2.0 pm
6. Hydrometerologist	1.5 pm
7. Civil/Agricultural Engineer	1.5 pm
8. Land-Use Planner	1.5 pm
9. Statistician	2.0 pm
10. Computer Specialist	2.0 pm
11. Soils Specialist (Laboratory)	2.0 pm
12. Agricultural Training Specialist	3.0 pm
13. MIS Specialist	1.0 pm

C. Procurement of Commodities.

Approximately dols 300,000 worth of spare parts for heavy equipment and dump trucks are in the process of being ordered for DGCSAFER under the WDP project and these commodities will be available for use under the WARD project. The following types of commodities are to be procured under the WARD project: project vehicles and spare parts, research and laboratory equipment, office supplies, visual aids, construction material, tools and scientific instruments. Some project vehicles with spare parts and other priority items will be obtained by OAR/Cape Verde using AID Direct Procurement Procedures. It is likely that a direct fixed price contract for housing rehabilitation will also be executed by OAR/Cape Verde. All other procurement will be the responsibility of the recipient. (see Annex J for an illustrative list of commodities to be procured for the WARD project).

Participant Training

The project will finance nine long-term degree candidates at selected American universities. Most degree programs will be initiated in the first two years of the project in order to allow participants several productive years working with American counterparts upon return to Cape Verde. It is anticipated that short-term training will be conducted in-country, although some short-term training may be in the U.S. or third countries. All training activities will be on a direct payment basis, under the responsibility of the recipient of the cooperative agreement.

Financing Mode

Implementation of the WARD project will be through a PVO and/or University by means of a cooperative agreement. The cooperative agreement will be financed by Direct Payment or Letter of Credit-Treasury Financial Communications Systems (LOC-TFCS) if the recipient qualifies. All direct payments for Project Elements 1,2,3, and 4 will be made by the recipient.

Exception is made for the priority commodities to be imported by OAR/Cape Verde before the TA team arrives. Such commodities would likely be made by direct payment through purchase orders or through a Procurement Services Agent (PSA). The PSA will be paid through a Bank Letter of Commitment since a proliferation of invoices is anticipated. However, the agents fees will be paid with a Direct Letter of Commitment.

Project Elements 5, 6 and 7 will be by Direct Payment. The services of the WARD project manager will be by direct payment under a Personal Services Contract (PSC). External evaluations and audits will take place separately at the end of the second, fourth and seventh years through IQC delivery orders.

If OAR/Cape Verde contracts for the rehabilitation of housing (project element 8), it will be by a direct payment through a fixed price contract. Project element 9, contingency, will be used only for the purpose of budget realignment. No expenditures will be made under the line item Contingency.

The WARD project will fully comply with Gray Amendment and Section 8A requirements. In particular, the 17 Historically Black Colleges and Universities that are considered Title XII institutions or minority PVOs will be encouraged to submit applications for the main cooperative agreement. The ten percent sub-contracting set-aside for disadvantaged firms will be followed where applicable.

Methods of Implementation and Financing
(DFA-funded goods and services)

Project Element	Method of Implementation	Method of Financing	Estimated Cost ($ 000's)
1. Technical Assistance	Coop. Agree.	TFCS-LOC or DP	4,822
2. Training US/3rd count.	Coop. Agree.	DP	1,244
3. Commodities, Packing, Ins., Freight	Purchase Ord.	DP	50
	Coop. Agree.	DP	665
	PSA	BLCom	250
	Agent Fees	DLCom	50
4. Operating Expenses	Coop. Agree.	DP	339
5. Project Manager	PSC	DP	305
6. Evaluation/	IQC Delivery Order	DP	225
7. Audits	IQC Delivery Order	DP	150
8. Housing Rehab.	FPC	DP	50
9. Contingency	n/a	n/a	850
Total Cost			9,000

Key:
- LOC-TFCS - Letter of Credit-Treasury Financial Communications Systems
- DP - Direct Payment
- PSA - Procurement Services Agent
- PSC - Personal Services Contract
- BLCom - Bank Letter of Commitment
- DLCom - Direct Letter of Commitment
- IQC - Indefinite Quantity Contract
- FPC - Fixed Price Contract

D. Project Management

A.I.D. Project Management

In order to ensure that the project is successfully implemented in a manner fully consistent with GOCV policies, and is fully coordinated with the relative GOCV institutions, a project Coordinating Council will be formally established early in project implementation (see Section VI.E and Annex D.5). This council will also provide important oversight to project monitoring and evaluation. OAR/Cape Verde will oversee the project in consultation with the council.

The day to day management and execution of the project will be carried out by the Consortium and their counterparts in INIA, DGCSAFER and DGER.

OAR/Cape Verde currently has a two-person U.S. direct hire staff -- an AID representative and a general development officer. As soon as the WARD project is authorized, OAR will recruit a PSC project manager to be funded from project funds. This person will be under the GDO, but will have day-to-day responsibility for management of all WARD activities. He/she will also facilitate the operations of the coordinating council and will be responsible for ensuring that project impacts are properly monitored. The person selected for this position will have a strong background in agriculture development, and will have special capability in program impact analysis.

As a Schedule B mission, OAR/Cape Verde project implementation actions are subject to the concurrence of the REDSO director in Abidjan. Therefore, management of the project will benefit from and require the on-going technical and programmatic support of REDSO personnel. In addition, REDSO will provide scheduled assistance as necessary in the areas of financial management, commodity procurement, training and food aid. Regular field consultations will also be conducted by the appropriate technical offices of REDSO (e.g. agriculture, environment). Legal assistance will be provided by the Regional Legal Advisor/Abidjan. Contracting assistance will now be handled by the Regional Contracting Officer/Dakar.

IV. PROJECT EVALUATION, MONITORING, AND AUDITING

WARD will benefit from several project monitoring methods. In addition to implementation monitoring by project personnel, the USAID project manager, and the USAID direct-hire staff, WARD will undergo several evaluations and audits. Regular monitoring and evaluation of PL 480 generated local currency programming will also be conducted. An early project evaluation will keep WARD on course, and a mid-term and final evaluation will evaluate project progress, impact, and lessons learned. Audits will be conducted as per AID regulations and guidance.

A. WARD Programming Flexibility

Operational mode changes are often necessary in multi-year projects. To facilitate project conformity to these changes, it is necessary to program some flexibility into project design/redesign and implementation. While not a true 'rolling design', several features have been designed to allow for program flexibility during implementation, including:

1. Early Evaluation - The first evaluation of WARD will be scheduled two years after project authorization. The purpose of this early evaluation is to flag problems, should they arise, early in implementation.

2. Institutional Assessment - The GOCV is in the process of making some significant institutional changes which may have an impact on how the WARD project is managed (see Institutional Analysis, Annex D.5). The Ministry of Rural Development envisions arrangement of its services into four institutions, each operating semi-autonomously through contract agreements. At this stage, it is not possible to know the form and pace of this reorganization, the impact of this arrangement, or the effect on the WARD project when the reorganization goes through. It may be necessary to conduct an assessment of new institutional arrangements during the first year of implementation (and prior to the early evaluation) in order to determine if project adjustments will be required. This assessment can be performed by two technical personnel with appropriate experience in institutional analysis.

3. Recurring Technical Assistance - The use of recurring TA supports well the flexible approach to project design. The timing and technical mix of required TA can be programmed in yearly work plans by WARD management and with guidance from the Coordinating Council. An illustrative list of technical assistance needs can be found in Annex J.

B. Evaluations

Evaluations will be essential in assessing project progress in light of planned institutional changes by the GOCV which could not be fully explored during design. In addition to periodic Mission project review and regular PL 480 evaluations, three formal evaluations will be conducted: after eighteen months or two years, at mid-term, and at project conclusion.

Early Evaluation

An evaluation of limited scope will be conducted about two years after project authorization. The primary purpose of this evaluation will be to assess the impact of GOCV institutional changes on project management and implementation. It will also serve as an evaluation of early project activities, such as training, in order to make any needed adjustments. This evaluation will respond to the following concerns:

1. How have INIA and DGCSAFER evolved since project authorization?

2. Are the management, administrative, and financial systems created by WARD still valid?

3. Have changes occurred in GOCV institutions making adjustments in WARD technical objectives or management approach necessary?

Results from this early evaluation will be used in adjusting management mechanisms, TA and training schedules, and the implementation plan. The evaluation team, the WARD management team, OAR/Cape Verde, and GOCV representatives will jointly agree on modifications required and methods and timetables for integrating those modifications.

Mid-Term Evaluation

A mid-term evaluation will be conducted four years after Project Authorization. It is recommended that this be an external review, with a team recruited and administered by an IQC firm or an institution selected through competitive bidding. The exact team composition and individual terms of reference will be established by OAR/Cape Verde in consultation with the GOCV. The evaluation team would probably include specialists in areas of: a) food aid programming, b) agricultural economics, c) applied agricultural research and water management, d) upland soil and water conservation, e) agroforestry, and f) extension/community development.

The evaluation team will assess progress in meeting WARD objectives as per the logical framework matrix. Besides evaluating in quantifiable terms what progress has been made toward achieving project outputs, qualitative consideration will be given to the effectiveness of WARD activities in meeting project goals and objectives. It will be valuable during this evaluation to assess impacts of changes integrated into WARD as a result of the early evaluation and to recommend further modifications if appropriate. Additionally, the evaluation team will judge the appropriateness and effectiveness of project TA, short- and long-term training activities, and commodities and assess the quality and timeliness of contributions made by all parties. It will also assess the impact of the project in terms of people level indicators against earlier baseline data.

Final Evaluation

Final evaluation will probably closely mirror the mid-term evaluation in team composition and SOWs. The evaluation team again will be recruited externally.

In addition to the issues considered in the mid-term evaluation, i.e. progress towards achieving outputs, effectiveness of TA, training, etc., the following will be addressed: what people-level programs can be documented; how flexibly WARD has responded to changed circumstances and the results of program impact monitoring efforts; the capability of INIA and DGCSAFER to continue WARD activities unassisted; and the need for follow-up activities, project extensions, or new projects.

In preparation for all project evaluations, OAR/Cape Verde will have responsibility for establishing schedules with project personnel and Cape Verdean counterparts for protocol meetings, personal interviews, and field visits. OAR/Cape Verde will arrange lodging, office space, transportation, collect relevant literature, and arrange other logistics in advance of team arrival.

C. Project Impact Monitoring

Monitoring of the WARD project needs to be on three levels. From the project management perspective, a monitoring plan needs to be in place that allows AID to keep abreast of WARD progress. The project officer, working with the project manager, has responsibility for monitoring the delivery of both GOCV and U.S. inputs and gauging the performance of project staff. Mechanisms for doing this will include quarterly and annual project reports and monthly meetings with WARD's Coordinating Council.

In another, more technical sense, monitoring biophysical processes in project watersheds will improve engineering and

hydrologic design of WARD SWC structures and methods. Described in detail in sections concerning soil and water conservation, this monitoring system will record and analyze rainfall, runoff, and soil erosion data. Information gained through this process will be crucial in assessing the sustainability of current and proposed cropping systems in terms of conservation of soil fertility and water use equilibrium, as well as providing the basis for adjustments of activities designed to achieve soil and water conservation targets.

The WARD project goals of increased sustainable agricultural production in Cape Verde and increased agricultural incomes to producers requires a monitoring system of even greater depth: assessing people-level impacts as well as biophysical data. The challenge of quantifying sustainability and the possibility that increasing agricultural sustainability may, on lands inherently unsuitable for annual cropping, decrease producer incomes in the short-term makes project monitoring a key element in gauging WARD's success. The process of developing a monitoring plan needs to clearly define: 1) what indicators will reveal progress and 2) how those indicators will be measured.

The creation of this plan will require first a series of baseline studies to fully evaluate the biophysical and socio-economic condition of project watersheds. Technical information from WARD watershed evaluation and monitoring activities will serve to identify base-line biophysical conditions in project watersheds. Baseline socio-economic studies and data collection will investigate key elements such as: 1) farm-level income, 2) sources of that income, 3) total and average per family irrigated and rainfed cropland, 4) patterns of land tenure, 5) crop yields under irrigation, 6) yields of rainfed crops, 7) cropping practices and preferences, 8) livestock role in agriculture, 9) rural nutrition, and 10) market data of agricultural products.

In addition to systematic tracking of biophysical and socio-economic impacts, WARD will mount a project-wide system for on-going monitoring of people-level impacts (PLI) across the LOP. This will follow upon the completion of start-up tasks such as compiling and synthesizing existing data and literature on the project area as a whole, conducting baseline studies of the target watershed, and identifying potential key-farmers and controls. THe long-term TA in socio-economics will be responsible for designing and establishing the PLI monitoring system.

With the information gained from the activities and studies described above, progress toward project goals and purposes can be monitored. Measurable indicators of increasing sustainable agricultural productivity include greater soil fertility and decreased soil loss to erosion; soil depth; the ratio of runoff to rainfall; and greater productivity both of irrigated and rainfed croplands. Change indicators will also include: cultivated

hectarage of land unsuitable for cropping; surface area of rainfed cropland treated with agroforestry or other improved cropping systems; and improved water-use efficiency on irrigated land.

The WARD goal of increasing sustainable income to farm families will also be monitored by tracking measurable indicators. Progress in this area will be manifested by decreasing reliance on workfront labor for income; greater agricultural productivity; greater diversity of income producing activity (i.e. expanded livestock production, microenterprises producing and selling agricultural products); improved nutrition of rural families.

V. CONDITIONS AND COVENANTS

A. Conditions Precedent

Disbursement of funds will be governed by conditions precedent, which in substance will be as follows:

First Disbursement. Prior to the first disbursement under the Grant, or to the issuance by AID of documentation pursuant to which disbursement will be made, the Grantee will, except as the Parties may otherwise agree in writing, furnish to AID, in form and substance satisfactory to AID, the following:

1. A statement of the name of the person(s) acting on behalf of the Government of Cape Verde for purposes of implementation of the WARD project, together with a specimen signature of such person(s).

2. A statement confirming that a WARD project coordinating council has been designated, along with the names of the persons comprising the council and the name of the chairperson of the council.

3. A statement confirming that a special account has been established, along with the number of that account, for deposit of all P.L. 480 revenues that are to be used by the DGCSAFER for soil and water conservation construction and afforestation activities.

4. A statement confirming that a special account has been established, along with the number of that account, for deposit of P.L. 480 revenues that are to be used by INIA to support the training and research aspects of the WARD project.

B. Covenants

In addition to standard general covenants, the Project Grant Agreement will contain special covenants, which in substance will be as follows:

1. The individuals trained under the WARD project will become members of the staff of INIA or DGCSAFER, or their successor institutions, upon completion of training, unless their work performance proves unsatisfactory.

2. The implementing offices of the Ministry of Rural Development and Fisheries will maintain thorough and up to date inventory records, documenting receipt, use, and disposition of AID-financed commodities.

3. The Ministry of Rural Development and Fisheries will ensure that all commodities procured under the Food Crop Research Project and Watershed Development Project are made available to personnel engaged in implementing the WARD project.

4. No funds provided under the Grant, nor goods or services financed under the Grant shall be used in connection with the purchase, application, transport or storage of pesticides other than those approved by the United States Environmental Protection Agency for the particular purpose for which they are to be used.

5. The Ministry of Rural Development and Fisheries and project management will make their best efforts to monitor, assess, and mitigate any adverse environmental impacts resulting from project activities.

VI. SUMMARY OF TECHNICAL ANALYSES

A. Agronomy and Applied Research

Agricultural activities in Cape Verde are carried out under a number of physical, climatic, and economic constraints. Most serious among these constraints include: an extremely variable yet characteristically low rainfall regime; shallow soils of low organic matter and fertility; limited sources of irrigation; and steep, rocky, highly erodible slopes. Crop yields are limited by these constraints on both rainfed and irrigated lands. They are also limited by current cultural and technical cropping practices. Evidence suggests that through proper soil and water management, agriculture in Cape Verde can be both more productive and sustainable.

The central consideration in defining WARD assistance in agriculture is to what extent research plays a role in driving agricultural production and sustainability. Four criteria were selected to define this role: 1) the rationale for continued investment in agricultural research in Cape Verde; 2) the relationship of problems and constraints in the areas of agricultural research, extension, and natural resources; 3) national commitment to the goals, objectives, and concepts of promoting sustainable agriculture; and, 4) alternative areas of investment in agriculture for the rural sector.

Continued investment in agricultural research is warranted due to Cape Verde's unique edaphic conditions and geographic isolation. There is substantial potential for significant increases in crop yield and stability. INIA has a highly educated and motivated staff of researchers who are result-oriented and productive in spite of logistical constraints.

The rationale for investing in agricultural research must also address the characteristics that research should acquire. INIA is modest in size and should stay that way. Research, to be efficient, must focus on priority problems from an adaptive and on-farm research perspective. Water is the principal limiting resource in agricultural production in Cape Verde, and management of water resources is a key production factor in all agriculture in Cape Verde. INIA's capacity to conduct on-farm research in the areas of production systems and water management is limited.

INIA's adaptive research program needs to consider other factors of production, such as the role and management of livestock and the intricate link between agricultural production and natural resource protection and enhancement. The research-extension linkage must also be forged in order to get results to farmers. On-farm research methodology offers INIA the most efficient and productive means of research.

INIA's ability to place more emphasis on on-farm research and to integrate disciplines to solve agricultural production problems has yet to be proven. It has a research staff that is both young and inexperienced, and many have suffered from a lack of senior-level advice upon return to Cape Verde. The FCRP trained a large number of researchers but had only one long-term U.S. agronomist to advise returnees. Future technical assistance should focus on training in research methods, guidance to research staff, integration of technician and extension personnel into research, and on generating appropriate and sustainable technologies.

Two issues remain to be resolved that could not be fully addressed in a PP-level analysis. The new institutional changes proposed by the GOCV may have significant impact on the research-extension link. The impact may be highly positive since research

and extension will be combined under one institute, but it is too early to assess all its implications and programs appropriate for project assistance. To address this issue, an early evaluation and institutional assessment has been recommended during year two of the project.

The second issue has to deal with socio-economic factors that influence the setting of research priorities. Systematic research in this area is limited in Cape Verde and surprisingly little is known about farmer concerns and constraints. Although INIA has some institutional capability, it will need strong input from experienced researchers in order to conduct baseline studies. Socioeconomic technical assistance is a key component of research under WARD.

B. Soil and Water Conservation

Santiago Island's natural resources reflect its geology and climate. The landscape is steep; soils are weakly developed, low in organic matter content and often infertile. Santiago's rainy season is short, commencing the end of August and lasting only a few months; its climate is warm and arid. Proven groundwater resources are limited to coastal lands and, in the interior, to accumulated channel-bottom alluvium and springs; saltwater intrusion is a principal constraint to groundwater development. During drought years irrigation is limited to terrace lands near valley mouths; irrigation of upstream areas occurs only during times of plentiful water supply. Soil losses are high despite the construction of many costly erosion control structures. Cropping of steep land for annual crops is a major cause of excessive soil loss.

Activities to conserve Cape Verde's soils predate its independence. Many of these activities relied on erosion control structures and reforestation, methods which continue to the present and that were supported by the WDP. Although soil losses under WDP were not monitored, evidence from similar soils and landscapes in other countries suggests erosion rates in Cape Verde that mitigate against sustainable upland farming. These rates of soil loss are confirmed by observation: bare soils, rills, and bare channel banks are all indicative of soil loss rates one to two orders of magnitude in excess of soil formation rates. Hydraulic structures of the type implemented in Cape Verde serve mainly to store coarse sediments such as sand and cobbles, the residue of soils. Clays and other highly mobile particles such as organic matter and fine silts, the principle constituents that contribute to soil fertility, are mainly discharged with runoff into the sea.

Coarse sediments, once entered into the stream channel, often remain resident for long periods of time. Structures provide focal points for their accumulation and may provide some benefit for ground-water supply. Retained behind structures, their water yield

is the same as that of an upwardly unconfined aquifer -- less than 20 percent of reservoir volume. During years of plentiful rainfall they may hold sufficient water to permit irrigation; during drought years water supply is limited to seepage along the contact zone between underlying, compact basalt and overlying sediments. Yield is low and recovery slow, about 12 hours to provide minimal water supplies for 200 to 400 people. Prorated over the life of a typical structure, the cost of the water it provides is about $20/m^3$. Desalinization plants provide water for a cost of $3 to $6/m^3$.

The effect of structures to conserve upland water, that is water infiltrated into the soil upstream of the structure and its reservoir, appears limited. A structure's zone of control is limited to the area defined by its sediments. Land lying beyond this fringe remains susceptible to the various processes of soil loss and runoff. Because erosion reduces soil depth and, concomitantly, soil moisture retention, water conservation over the majority of the WDP project surface remains unimproved. In fact, because erosion continues, water supply is worsening.

The effect of structures on ground-water recharge relates in part to their effect on the velocity of flowing water, the nature of the underlying rock. and the nature of the accumulated sediment. In Ribeira Seca, the underlying basalt is dense and not suitable for ground-water development: its rate of recharge is low.

The effect of structures, once filled with sediments, is limited to the effect of their accumulated sediments on stream energy gradient. For low flows, velocity reductions up to about 30 percent can occur; for high flows, however, other factors interact to reduce their benefit.

Rock walls widely spaced along the contour on sloping land accumulate a limited amount of sediment. Their effectiveness is limited to one part of the erosion process, sediment transport. They do little to reduce erosion's other component, that of particle detachment. By reducing the protection provided by stone cover overlying the soil surface, stone walls may increase soil loss from certain combinations of soil type and slope.

The social acceptance of soil conservation practices implemented to date in Cape Verde appears to be low. We saw few if any of WDP's erosion control practices being implemented on private land. While the WDP provided employment, its actual effect at reducing soil loss and improving water conservation appears to have been low.

Taking into account the above considerations, it is concluded that soil loss on Cape Verde continues at rates that mitigate against sustainable upland agriculture. To counter this trend, it

is proposed to introduce upland cropping practices which will be implemented by farmers on land they themselves farm. WARD's principle is to retain soils where they evolve on upland slopes, not their residues behind costly structures. It relies upon improvements in extension, the development of a suitable agricultural message, and implementation. Practicing farmers will execute WARD's methodology because they perceive its benefits as increased yields. WARD's emphasis changes from soil loss to soil productivity. In effect it is soil conservation through the back door: improving agricultural productivity through simple technology in which soil and water conservation is intrinsic to the method.

WARD's technology hinges on adjusting biomass production in ways that provide a volume and quality adequate to protect soil surfaces against rainfall and erosion. This can be achieved by changing hedgerow width, adjusting stripcrop width, modifying plant combinations and intercroppings, etc. Obviously, at some critical combination of slope, soil and rainfall, the theoretical need for protective vegetative cover will leave little land available for crop production. Monitoring of soil losses will give WARD the means to identify this critical combination. Presumably, because WARD's technology is conceived to improve soil moisture storage in ways that increase crop productivity, this point will be somewhat high on the slope. At higher altitudes other practices such as sylvo-pastoralism and forestry are required.

Is WARD sustainable? This depends on its degree of acceptance by practicing farmers, itself related to the quality of extension provided and the benefits that farmers perceive. It also hinges on security of access to land. At this point it is understood that access rights remain within families and land tenure constraints may in fact be benign (see Social Soundness Analysis, Annex D.4). Careful monitoring and evaluation is essential to WARD's success. Based on information accumulated for preparation of this PP, the upland portion of WARD's activities are technically feasible. Complete success depends on its activities, particularly research, extension and monitoring, continuing long after LOP. It also relies on short and long term benefits being perceived by farmers.

Numerous structures suffer hydraulic design faults that pose risks to downstream irrigation developments and infrastructure; other structures are already in a stage of early collapse. WARD will use workfront labor to repair, upgrade and maintain these structures. Where structures provide a critical element of integrated watershed design, WARD will support their construction. The level of outputs of WARD reflect the design team's best estimate of the number of additional structures that can be built during the LOP that meet basic economic and technical feasibility requirements.

WARD will develop potentially irrigable lands in Ribeira Seca using workfront labor to level-terrace land and build conveyance systems. The objective of this activity is to provide hands-on training in correct irrigation design, and for demonstration purposes for replication in appropriate settings throughout Cape Verde.

C. Forestry and Sylvo-pastoral Development

In past projects, OAR/Cape Verde has prioritized tree planting as a means in stabilizing the environment in rural zones. Recently, the WDP planted over 3.5 million trees hoping to protect existing engineering works in stream channels from excessive rainfall runoff and soil erosion. But although substantial numbers of trees have been planted as part of GOCV and USAID efforts in soil and water conservation, much work remains in achieving environmental stability. Severe soil erosion and uncontrolled runoff continues, particularly on marginal rainfed agricultural land. For this reason, careful consideration will be given to forestry, agroforestry, and management of sylvo-pastoral areas when developing the WARD implementation plan.

This analysis examines four general areas pertaining to forestry and sylvo-pastoral management. The work being done by GOCV agencies and donor-funded projects is evaluated for technical merit, the capacity and use of human resources, monitoring and planning, and technology transfer. The goals of the analysis are to: 1) determine the extent to which the DGCSAFER DSF has assimilated technologies promoted by WDP, 2) estimate DSF capacity to continue certain activities without further technical assistance, 3) identify new technical areas needing assistance by WARD, and 4) determine inputs needed to complement DGCSAFER capabilities in target areas. Within this analysis, certain issues are addressed such as concerns about the diversity of tree species being planted, changing policies towards the use of workfront labor, and the potential for cooperation or overlap with other donor-funded projects.

Findings and conclusions reached in this analysis will help guide WARD's areas and modes of implementation. These include:

- the type of afforestation work supported by WDP is within the capabilities of the DSF. The DSF is also receiving considerable support in this area from an FAO/Belgium Forestry Project;

- tree, shrub, and grass planting for soil and water conservation <u>and</u> sustainable agricultural production must target steep rainfed cropland. DGCSAFER and donor-funded projects have had little impact to date;

- better research and extension support is needed to develop and promote agroforestry and sylvo-pastoral systems acceptable to farmers; and

- new GOCV strategies calling for decentralization and diminishing use of labor fronts will require greater private sector involvement in forestry-related activities.

Based on findings and conclusions from this analysis, the PP Design Team has programmed a number of WARD activities in the forestry sector. Past activities have been identified that were valuable but will require further project support. Determinations have also been made on new approaches and activities that will become part of the WARD implementation plan. Proposed WARD activities specific to the forestry sector are as follows: Continuing support to DGCSAFER in the production and plantation of three million tree seedlings and the integration of planning methodologies into the Forestry Division. Forestry, agroforestry, and sylvo-pastoral research investigating new species of trees, shrubs, and grasses and socially acceptable agroforestry and agro-sylvo-pastoral systems. Agroforestry, fruit production and sylvo-pastoral development packages for on-farm implementation using extension personnel to recruit farmer support and cooperation. Promotion of private sector forestry activities by study of the potential for private sector tree seedling production, tree planting, fuelwood harvest and marketing, fabrication of forestry materials, and/or sales of secondary tree products.

Progress in these areas should result in several improvements in forestry sector activities on Santiago. The DSF will have increased professional staff in several technical areas, implemented better management practices, and increased mid-level field staffing. Better cooperation will exist among DGCSAFER, INIA, and DGER to conduct relevant research and extension. Large numbers of trees will be planted and significant areas of rainfed cropland will be treated with agroforestry systems. Finally, forestry work through unsustainable workfront labor will have decreased through greater private sector involvement.

D. Social Soundness

Cape Verde enjoys exceptional linguistic, ethnic, and religious unity -- a plus for development efforts. But this island nation also presents many development challenges. Literacy rates average 61% among all agricultural age groups; the demographic profile is skewed by high emigration among adult males; and the country's limited and eroding agricultural land base is under siege by acute population pressure and a harsh, Sudano-Sahelian climate further complicated by a volcanic topography.

Currently, 53% of the populace live in rural areas where they engage in agrosylvopastoralism, sometimes along with crafting or other microenterprises like dairying. Yet under current land-use regimes, rarely are these endeavors productive enough to support rural families yearround. Remittances from relatives working abroad make up part of the shortfall. In addition, approximately 60% of rural families rely on state-supported workfronts for some or all of their annual cash income. Other rural families may instead chose to seek their fortune in the cities, which are thus growing at 4.4% annually.

WARD will focus its efforts on Santiago Island, which contains 51% of Cape Verde's inhabitants, 56% of its agricultural families, 57% of the country's arable land, and one of the nation's highest population densities (173/km^2). While stresses on the natural resources on which sustainable agrosylvopastoralism depends are thus commensurately greater on Santiago, so are the opportunities for project impacts and benefits.

Project sites and beneficiaries have already been described in earlier sections. Thus other aspects of the social soundness analysis are summarized here. Detailed demographic, production, and other data are available in Annex D.4.

Producer participation will take several forms. One is as members of community-based workfronts (CBWFs). Supported by the Rural Assistance Program, a locality based extension assistant system (RAP), these groups have input into the selection of CBWF crew leaders and workers as well as the siting, scheduling, and planning of large-scale CBWF tasks. Workers also receive some training in technical aspects of soil and water conservation (SWC) measures (e.g. stonemasonry, contouring, seedling production and care). In addition, CBWFs and other local-level groups will participate in a WARD-supported self-help program in which they select from a menu of "mini-projects" (e.g. wells, canals nurseries, livestock groups) that they themselves negotiate implement, and contractually agree to administer and maintain, wit only initial technical advice and material support from WARD. Equally important, producers will participate in WARD as co-researchers and co-developers in on-farm R&D. A subset of producers -- the RAP personnel, who themselves live in the project watershed -- will also participate. Yet another form of participation is planned, via training opportunities for both producers and RAP personnel. Prior to all the foregoing activities, however, producers in the target watershed will be polled as to local opinions, suggestions, and priorities with regard to project activities and approaches.

Representatives of all Cape Verdean institutions directly involved in WARD actively participated in both PID and PP development. They will continue to play an integral decision-

making role throughout the LOP via membership in a project Coordinating Council and a Training Committee.

Rural Cape Verdean communities display a healthy number of social structures for cooperation and self-help, such as community-based workfronts, savings societies, irrigation associations, and more. Relations between landowners and their sharecroppers or renters are reportedly benign, with access rights passed down indefinitely from fathers to sons. These findings bode well for the sociocultural feasibility of instituting SWC and agrosylvopastoral improvements that rely on group coordination, such as water user networks or community nursery enterprises. The project can readily build upon these existing "human structures." First, however, a clearer understanding of current systems of land, water, and tree tenure is needed. Particularly in view of recent attempts at agrarian reform, it is important to determine any constraints to non-landowners' making long-term, large-scale, costly, or risky investments in structures or vegetation. At project start-up, WARD will therefore initiate a thorough study of such issues.

Another important task to ensure the sociocultural feasibility of WARD will be intensive training for Cape Verdean researchers and extensionists in principles and approaches to interdisciplinary, collaborative, and participatory on-farm Research, Development and Extension (RD&E.) Furthermore, to ensure that on-farm activities are logistically feasible in terms of day-to-day linkages between producers and researchers, WARD will seek ways to augment the number and type of field-level personnel, e.g. through collaboration with IFAD personnel, recruitment of additional extensionists or para-extensionists, model farmers, and Peace Corps volunteers.

Equity concerns include the 40% of rural Santiago families headed by women, who labor under distinct farming system constraints, and the 76% of Santiago producers who work rainfed lands only. However, the majority of irrigated farmers also cultivate dryland. To avoid "shortchanging" these groups, WARD will pay special attention to women's needs and will simultaneously explore agrosylvopastoral interventions suitable for drylands. In addition, WARD will collaborate closely with the Ribeira Seca IFAD project -- which is focusing exclusively on rainfed farming -- both to avoid duplication of R&D efforts and to ensure that useful findings for both groups are exchanged and extended. Finally, WARD will emphasize that new irrigated land be made available to families who currently lack access to this valuable resource, rather than merely extending the holdings of existing irrigated producers.

In watershed improvement, benefits can sometimes bypass producers in the upper reaches of the watershed -- where, however,

proper management ideally begins. To ensure that downstream producers are not the only ones to benefit, WARD will also institute technically feasible interventions in upstream communities that directly redound to their benefit (e.g. spring development, sylvopastoral improvements). Finally, based on the study of tenurial systems noted above, WARD will take steps to ensure that profits from project-initiated improvements are not disproportionately captured by landowners rather than the sharecroppers and tenants who actually work the land.

With regard to spread and sustainability, broad and long-term impacts from WARD can be expected in numerous ways. The expenditure of some U.S. $7.2 million of local currency generated through PL 480 on workfront salaries constitutes a significant stimulus to the rural and even the island-wide economy. As workfronts are phased down and sustainable agrosylvopastoral systems are designed and phased in, the national economy stands to benefit from decreased welfare, increased and more diversified production, savings or more advantageous allocation of foreign exchange, and reduced rural-to-urban migration.

Country-wide impacts should also result from: the overall strengthening of institutions and their personnel in environmentally sound and sustainable agricultural research, development, and extension (RD&E); improved coordination among these institutions; a model of participatory, on-farm RD&E that can be applied throughout Cape Verde; new technologies and practices that are of potential use elsewhere in the nation; and fresh insights and data from tenurial research and experiments with different owner/user access rights that could be of immediate value to policy makers as they move forward with what is, in effect, integrated environmental law.

The social and economic value of restoring and sustaining a nation's land, water, and forestry resources for both present and future generations is inestimable. Likewise for devising and disseminating more participatory and democratic forms of development. In the long run, these less readily quantifiable impacts could constitute WARD's most important and lasting contribution.

E. Institutional

The GOCV has a relatively well-developed institutional capability to support the objectives of the WARD project, partly due to institution building components in AID funded predecessor projects (WDP and FCRP). Deficiencies in professional staff and equipment have been noted in the analysis and programmed for correction in the PP Training Plan, the scheduling of Technical Assistance and in the Procurement Plan.

The anticipated reorganization of the GOCV may require adjustments in WARD project management. The institutional analysis reflects current GOCV thinking about how the agriculture sector organization will be changed, but final decisions have not yet been made. A major priority of the new government is to reduce government expenditures. It intends to organize some functions into semi-autonomous institutes which will in theory become self-sufficient in the future. This will probably affect agricultural research, extension and conservation of soil and water - major concerns of WARD. A project evaluation has been scheduled early in project life to determine how the institutional changes will affect WARD management and activities.

GOCV reckons that the new institutional structure will provide additional incentives for trainees to return and for employees to remain on their jobs because of more competitive salaries under the new system.

A Coordinating Council, chaired by the Minister of Rural Development and composed of GOCV (INIA, DGCSAFER, DGER), USAID and project management, is proposed to provide policy guidance and to coordinate the project. The Coordinating Council will also provide a forum for cooperation with other donors, particularly IFAD. The suggested composition of the Coordinating Council, before and after reorganization, is shown in Annex D.5.

F. Financial and Economic

The financial costs of WARD are those shown in the proposed budget (see VII, Cost Estimate and Financial Plan), $9,000,000 from the U.S. Government and $9,443,000 from the Government of Cape Verde. Most of the GOCV contribution will be generated from the sale of PL 480 Title II commodities under a PVO-managed Title II monetization program. These monies will be expended over a period of seven years but many of the benefits from the project should continue up to 25 years.

The major financial benefits from the WARD project are assumed to be:

- Additional Irrigated Land - Potential exists for the addition of 300 hectares of irrigated cropland on Santiago. Project interventions island-wide will result in the addition of up to 50 additional hectares of irrigated land, including 8-10 on the target watershed.

- Increases in Agricultural Production - The project will result in increases in production from irrigated land, rainfed land and livestock, primarily through increases in yield per unit of land or livestock unit.

- Fuelwood - Tree planting during project life will result in increased supplies of fuelwood.

Analysis of the financial costs and returns of the WARD project indicate that the benefits far outweigh the costs. Even when the time value of money is considered, the project is "profitable." The Internal Rate of Return is calculated at ten percent over a twenty-five year period.

The question of "real" costs and benefits and to whom the benefits accrue (economic analysis) is more difficult. Although the beneficiaries have been identified (Section IV.D and Annex D.4) and some of the benefits they will receive are known, the social and opportunity costs and the shadow prices necessary for social/economic analysis could only be obtained after additional studies which are outside the scope of this design process. It is fairly safe to say, however, that the stream of economic benefits and costs would yield an acceptable rate of return.

G. Environmental

Portions of the WARD project funded under GOCV-owned PL 480 local currency generations do not fall under the AID environmental procedures recommended by the regulation 22CFR216. It is recommended, however, that an Environmental follow up be undertaken for some of the activities planned in the project. Those activities which could have adverse effects on the environment in addition to the positive ones they are designed for are: damming for water retention, irrigation and land leveling. This would be in the form of a monitoring system that thoroughly and continuously assesses environmental changes related to project activities. The reason to set up a monitoring system from the very beginning of project implementation is to guarantee the safety and security of the farmers. A failure of a dam, water borne disease development or soil salinization could lead to the reverse of what was expected from the WARD project and cause more problems to the farmers than before.

Agroforestry and sylvopastoral development are recommended for categorical exclusion under 216.2(c)(2)(iii) for the study component; under 216.2(c)(2)(ii) for the technology packages development; and under 216.2(c)(2)(i) for the extension and training component.

The institution building and reform assistance to DGCSAFER and INIA component of the project is recommended for categorical exclusion under 22CFR216.2(c)(2)(xiv). The technical assistance component of the program is recommended for categorical exclusion pursuant to 22CFR216.2(c)(2)(i) since it is management, monitoring, planning, and advising; and suitable environmental sensitization can be included in the job descriptions of the advisors. Technical

assistance is needed for research, training, design, studies, extension services, logistical support, commodity procurement, analyses, and monitoring of the conditions precedent of local awareness campaigns.

The training component is recommended for categorical exclusion under 22CFR216.2(c)(2)(i), but offers a unique opportunity to result in a positive environmental influence. Environmental sensitization training can be designed into training programs and be provided to researchers, extensionists, workers, and farmers, at all levels of the government including the education system.

The applied research component for agriculture and forestry is recommended for categorical exclusion under 216.2(c)(1)(iii) or 216.2(c)(2)(iii) because the experiments will be in limited scope, confined to small areas, carefully controlled, and efficiently monitored.

The commodity import program is recommended for categorical exclusion under 22CFR216.2(c)(2)(xii). The importation of a limited number of vehicles, spare parts, office equipment, motor pumps, computers and other commodities are not foreseen to have significant impact upon the environment. However, effects of motor pumps on water table should be carefully monitored to prevent any unforeseeable risk in loss of agricultural lands through salt intrusion.

The title II food assistance portion of this project is recommended for categorical exclusion under 22CFR216.2(c)(2)(xi). The local currency account generated from the sales of these food commodities lies outside the purview of the Regulation 16. It is these monies which will finance Workfront work programs in the watersheds.

While not currently contemplated, if the commodity imports include pesticides they will be subject to review pursuant to 22CFR216.3(b) and will require clearance before importation and use. A covenant is necessary to limit the use of project funds or local currency for the purchase or importation of pesticides.

VII. COST ESTIMATES AND FINANCIAL PLAN

A. Cost Estimate

Summary Cost Estimate
(US $ 000)

Project Element	AID FX	AID LC	GOCV FX	GOCV LC	PL 480 LC	Total
Technical Assist.	4,822					4,822
Training	1,244				445	1,689
Commodities	1,015					1,015
Operating Expenses	100	289			750	1,139
Evaluation	250					250
Audit	125					125
Project Management	50	255				305
Workfront Payments					7,248	7,248
GOCV Personnel				580		580
In-Kind contribution				820		820
Contingency	694	156				850
TOTAL	8,300	700		1,400	8,443	18,843

B. Schedule of Annual Expenditures

A schedule of annual expenditures is shown on the following page.

The $752,000 budgeted for commodities does not include the $300,000 in spare parts to be imported unde&r WDP in 1992.

Only one million dollars of monetized PL 480 Title II local currency generations was allotted for workfront payments under WARD in year one of the project because it is assumed that the existing funding mechanisms under the FY 1991 Section 416(b) program will finance the ongoing WDP program for rural construction and forestry at least during the first half of 1992.

C. Schedule of Annual Obligations

It is planned for DFA funds to be obligated to the WARD project according to the following schedule:

Fiscal Year	US$ Obligations
1991	$1,800,000
1992	1,800,000
1993	1,800,000
1994	1,800,000
1995	1,800,000

Each obligation will require the approval of REDSO/WCA. All funds will be administratively controlled by REDSO/WAAC in Abidjan.

COST ESTIMATE AND FINANCIAL PLAN
WARD
000 U.S. Dollars

ITEM	TOTAL	YEAR ONE	YEAR TWO	YEAR THREE	YEAR FOUR	YEAR FIVE	YEAR SIX	YEAR SEVEN
USG								
Technical Assistance								
Long term	2920	200	510	487	417	446	477	383
Recurring short term	1320	162	299	196	287	212	164	
Regular short term	582	132	174	134	66	24	25	27
Training								
Long term								
U.S.	891	50	214	243	184	147	53	
Short term								
U.S.	282		101	64	60	28	29	
Third country	71	10	5	17	25	7	7	
Commodities	752	200	350	152	20	20	10	
Packing, Ins., Freight	263	70	122	53	7	7	4	
Operational Expenses								
TA Support Costs	200	10	40	50	30	30	20	20
Administrative Assistant	120	10	18	18	18	18	18	20
Housing Rehab. & Maint.	50	30	5	5	5	5		
Other	19	2	2	3	3	3	3	3
External Evaluation & Audit	375		125		125			125
Project Management	305	40	40	40	45	45	45	50
Contingency	850	100	130	130	130	120	120	120
GOCV/PL 480								
Work Front Ments. (PL480)								
Structures and forestry	7248	1000	1470	1110	1053	1027	827	761
In-country Training	445	7	182	177	56	8	10	5
Project Related Local Costs	750	80	90	100	110	120	130	120
GOCV								
In-kind Contribution	820	100	100	120	120	120	130	130
Personnel	580	70	80	80	80	90	90	90
TOTAL - USG	9000	1016	2136	1592	1422	1112	975	768
TOTAL - GOCV/PL480	8443	1087	1742	1387	1219	1155	967	886
TOTAL - GOCV	1400	170	180	200	200	210	220	220
GRAND TOTAL	18843	2273	4058	3179	2841	2477	2162	1854

ANNEXES

WATERSHED APPLIED RESEARCH AND DEVELOPMENT PROJECT

ANNEX A

LOGICAL FRAMEWORK
WATERSHED AND APPLIED RESEARCH DEVELOPMENT

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Assumptions
Goal: To increase sustainable agricultural production in Cape Verde and, concomitantly, increase incomes to producers.	-increase in farmland under sustainable practices -decrease in soil erosion -increase in income from sustainable agriculture	-Farmer surveys in target watershed -Measurement of runoff	-No severe drought that would discourage farmer risk-taking. -Continued food aid.
Purposes:	End of Project Status:		
1) Strengthen the capacity of DGCSAFER to conduct SWC activities, including afforestation programs, but with increased emphasis on: improved structure design, selection of construction sites, and development of alternative implementation approaches that rely less on traditional public employment schemes.	-Marked improvement in design and selection of SWC structures built/rehabbed. -Decreased reliance on traditional workfront arrangements for further construction/maintenance of SWC structures.	-Project evaluations -INIA records -DGCSAFER records -Existence of longer term research plans	-GOCV will continue to foster appropriate natural resource conservation policies. -Other donors will continue to support related agricultural and agroforestry development activities. -GOCV will continue to fund INIA and DGCSAFER at appropriate levels. -Continued stability in staffing at INIA and DGCSAFER.
2) Strengthen the capacity of the National Agricultural Research Institute in on-farm research, cropping systems/water management research, and evaluation/monitoring in bio-physical and socioeconomic spheres.	-Increased quantity and usefulness of INIA research -Increased percentage of SWC research undertaken in the field. -On-going systems to monitor performance of SWC structures.		
3) Reinforce coordination among GOCV institutions in areas of natural resource and agricultural development, and in particular enhance the linkage between research and extension.	-longer term research management plans developed. -regular collaborative exercises undertaken by research and extension staffs.		
Outputs	Magnitude of Outputs		
1) Implementation of improved upland farming methods.	1) 1,000 ha. in Ribeira Seca under improved upland farming methods (e.g. hedgeg ow agroforestry, agroforestry stipcropping, contour tillage, seeding to optimal densities).	-Project evaluations. -Contractor reports. -INIA records. -DGCSAFER records.	-Trainees return to their GOCV agencies. -Commodities arrive on time. -Workfront workers are paid promptly. -Absence of severe drought conditions.
2) Design and construction	2) Approximately:		

of water and soil conservation structures.	· 330 tributary channel structures. · 25 main channel structures. · Rehabilitation of 40 principal structures.
3) Demonstration development of irrigable lands.	3) Development of 9 ha. of irrigated land for demonstration purposes.
4) Reforestation of environmentally fragile lands.	4) Tree planting in each sub-watershed, including 30,000 fruit trees.
5) Introduction and testing of tree, shrub, and forage species.	5) 20 varieties tested, and planting of alternative varieties to Prosopis juliflora and Acacia holosericea reaches 70%.
6) Introduction of agroforestry and on cropland and sylvo-pastoral rangeland.	6) This corresponds to Output #, and will include 6 demonstration sites. 7) 4 short courses provided for INIA staff, and 11 on-farm trials conducted.
7) Development of applied research capacity at INIA in areas of cropping systems, water management, and varietal improvements using on-farm methodology.	
8) Improved research planning and administration at INIA.	8) Improved performance in setting research priorities, streamlining management processes, and developing proposals.
	9) Improved extension information, based on adaptive research developed and in use.
9) Improved technology transfer through strengthened research-extension linkages.	
	10) Monitoring system focussing on 4 SWC topics is on-going.
10) Development of SWC monitoring and evaluation systems.	11) 3 INIA/DGCSAFER staff trained to bachelor's level and three to masters level. 30 staff trained in country in technical/extension skills.
11) Improved technical capacity of DGCSAFER and INIA in SWC activities.	

Inputs	Level of Effort		
DFA:			
1) Technical Assistance	$4,822,000	·Contractor reports. ·Project implementation reports. ·REDSO/WAAC records.	·Suitable U.S. personnel with language skills can be recruited on schedule. ·Project management structure functions effectively. ·P.L. 480 food delivered as scheduled.
2) Training	1,244,000		
3) Commodities	1,015,000		
4) Operational expenses	389,000		
5) Evaluation and audit	375,000		
6) Project management	509,000		
7) contingency	850,000		

GOCV(P.L. 480):

1) SWC construction and afforestation	7,248,000
2) In-country training	445,000
3) Research, extension and training support	750,000

GOCV:

1) Personnel	580,000
2) In-kind (office space, etc.)	820,000

Note: the EOPS indicators will be revised and quantified by the Mission after the first year of the project, following baseline analysis to be done by the recipient and the GOCV.

Illustrative Budget
(US $ 000)

Project Element	A.I.D.	GOCV	GOCV PL 480	Total
Tech. Assistance	4,822			4,822
Training	1,255		445	1,689
Commodities	1,015			1,015
Project Admin.	339		750	1,139
Housing Rehab.	50			50
Evaluation	225			225
Audit	150			150
Project Management	305			305
Workfront Payments			7,248	7,248
GOCV Personnel		580		580
In-kind Contribution		820		820
Contingency	850			850
TOTAL	9,000	1,400	8,443	18,843

ANNEX B

PID APPROVAL CABLE

ACTION --> A.I.D. 4 INFO: AMT

VZCZCRRCB97BAC148
RR RUEHRR
DE RUEHC #9919 1472723
ZNR UUUUU ZZH
R 232724Z MAY 91
FM SECSTATE WASHDC WAITING FOR TABLE
TO RUEHRR/AMEMBASSY PRAIA 2266
INFO RUEHAB/AMEMBASSY ABIDJAN 7323
BT
UNCLAS STATE 169919

INFO: DIRL 794 647
23 MAY 91 2723
CN: 43444
CHRG: AID
DISTR: AID

John Yes

AIDAC ABIDJAN FOR REDSO/WCA

E.O. 12356: N/A
TAGS:
SUBJECT: CAPE VERDE-WATERSHED AND APPLIED RESEARCH (WARD) (655@017)

REF: A) STATE 163779 (NOTAL) B) PRAIA 01138 C) STATE 139157 D) PRAIA 00936 E) PRAIA 01137 F) WERLIN-JONES TELCONS

1. THE STATUS OF THE PROJECT DESIGN AND OBLIGATION OF THE WARD PROJECT IS OF CONSIDERABLE CONCERN TO AID/W. IF AT ALL POSSIBLE, THE PROJECT SHOULD BE OBLIGATED THIS FY. THIS IS OF PARTICULAR IMPORTANCE IN VIEW OF THE DIFFICULTIES IN DEVELOPING AN ACCEPTABLE LAY-OFF PLAN, WHICH WILL BE DISCUSSED IN A SEPTEL.

2. WITH THE RESOLUTION OF THE TRANSPORT COST ISSUE (REF A), THE PIO CAN BE CONSIDERED OFFICIALLY APPROVED.

3. THE DESIGN SCHEDULE CITED REF B WILL PERMIT AN AUGUST 31 OBLIGATION, WHICH IS ACCEPTABLE TO AID/W. IT IS ESSENTIAL THAT THIS SCHEDULE BE MAINTAINED, AND IF POSSIBLE, ACCELERATED. PLEASE ADVISE DATE OF PIO/T SUBMISSION TO REDSO AND INITIATION OF DESIGN WORK. IF THERE IS ANY DELAY IN THE SCHEDULE, PLEASE ADVISE ASAP.

4. REF C AND VARIOUS TELCONS REFER TO UNRESOLVED PROBLEMS IN THE AREA OF MAINTENANCE OF CONSERVATION STRUCTURES AND RELATED ISSUES. PLEASE ADVISE ON STATUS OF GCCV DECISIONS ON THESE ISSUES AND EXACTLY WHAT PROBLEMS NEED TO BE RESOLVED BEFORE PROJECT CAN BE AUTHORIZED.

5. SEPTEL WILL ADVISE RE MONETIZATION OF PLANNED TITLE II PROGRAM (REF E) AND WORDING OF SECTION 416 AGREEMENT.
BAKER
BT
#9919

NNNN

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Annex C

Section 611 (a) Analysis

Section 611 (a) of the Foreign Assistance Act requires that, prior to obligation of funds, certain analyses be made concerning the technical, financial, and legislative plans germane to the Project s success.

Technical

This project paper contains a full technical analysis of all aspects of the WARD Project. This includes analysis of the technical feasibility of carrying out further research and construction in the areas of soil and water conservation, forestry and agro-forestry, and applied research in water management and cropping systems. The Project design team found that within each of these areas, research is likely to lead to improved methods, which in turn will lead to increased farm output derived from sustainable agricultural practices. A number of these technologies were tested under predecessor projects in controlled off-farm environments. Many others have been field tested elsewhere in Africa and now require adaptive research in Cape Verde. This Project is designed to fully test technologies in the field before advocating broader adoption in Cape Verde.

Appropriated funds will not be used to fund the actual construction works (rockwalls, checkdams, etc.), so environmental assessment of these works is not required by A.I.D. regulations. However, to better understand the unforeseen environmental consequences (positive and negative) of project activities funded by the GOCV, environmental analysis is included as one of the project elements.

Financial

This project paper contains a financial plan for expenditure of Project resources over the seven-year life-of-project. The figures shown in Chapter VII of the project paper were developed by the design team and are based on analysis of current local and overseas costs, and allow for projected inflation and contingencies. The financial plan provides for a reasonably firm estimate of the Project's cost to the United States Government. The limit is set at a life-of-project commitment of $9,000,000.

It is concluded that the financial plan provides sufficiently specific and realistic identification of recurrent costs, capital expenses, and resource development costs to fulfill 611 (a) (1) statutory requirements.

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Legislation

The Government of Cape Verde is in the process of revising various land use and forestry codes applicable to the entire country. The design team examined the potential significance of the proposed revisions, and concluded that none of these revisions are essential for Project implementation nor for the achievement of the project goal and purposes. Nonetheless, the Project may provide limited technical assistance to the Government of Cape Verde in further development of land use and forestry codes.

Conclusion

It is concluded that the requirements of 611 (a) have been met.

Certification under Section 611 (e) of the Foreign Assistance Act of 1961, as amended

I, Thomas C. Luche, the principal officer of the Agency for International Development in Cape Verde, have determined that Cape Verde has the capability in both financial and human resources to maintain and effectively utilize the capital goods and services provided by the Watershed and Applied Research Project (655-0017). The project will fund technical assistance, training, and commodities for on-farm and adaptive research in sustainable agriculture, and construction of watershed management works funded by the Government of Cape Verde with local currency generated through a P.L. 480 program. Based on knowledge of the Country and past experience with similar projects in Cape Verde, it is my judgement that Cape Verde can sustain the project.

Accordingly, I certify that, based on my professional judgement, Cape verde has the financial and human resources to effectively maintain and utilize the project outputs.

Thomas C. Luche

Thomas C. Luche
A.I.D. Representative
USAID/Cape Verde

13 August 1991
Date

Annex D.1.

AGRONOMY AND APPLIED RESEARCH ANALYSIS
WATERSHED AND APPLIED RESEARCH DEVELOPMENT PROJECT

I. INTRODUCTION

The analysis presented here attempts to rationally determine appropriate agronomic objectives for the proposed Watershed and Agricultural Research Project (655-0017), hereafter referred to as WARD. The AID/Washington and REDSO/WCA approved Project Implementation Document (PID) is used as a point of departure for evaluating needs for WARD. However, since several important changes have occurred since conception of the PID (e.g. - a change in the Cape Verdean leadership, anticipated changes in food aid programming, etc.), project objectives are evaluated to determine if assumptions and priorities remain valid.

Agricultural activities in Cape Verde are carried out under a number of physical, climatic, and economic constraints. Most serious among these include: an extremely variable and low rainfall regime; shallow soils of low organic matter, fertility, and cation exchange capacity; limited water resources; and steep, rocky, highly erodible slopes. Other factors - an island economy with limited market infrastructure and export opportunities, farmer preferences for particular crops and cultural practices, and limited use of agricultural inputs - add to agricultural production problems in Cape Verde. As a result, crop yields are generally low, on both rainfed and irrigated lands, compared with those demonstrated through proper soil, water, and crop management.

Increasing agricultural productivity in Cape Verde will require focused attention on constraints and promotion of sustainable cropping practices. Promoting water and soil management practices, along with insuring a supply of appropriate crop varieties, are key to successful movement towards the goal of sustainable agricultural production.

WARD proposes to focus on fundamentals of sustainable agricultural production in Cape Verde: stabilization of soil, efficient use of water resources, and adaptive, on-farm research. It will enhance Cape Verde's institutional capacity to manage resources through the supply of technical assistance, training, and equipment to the National Institute of Agrarian Research (INIA), the Soil/Water Conservation Service (DGCSAFER), and the National Extension Service (DGER).

Agricultural research is to be supported in the areas of on-farm research, cropping systems and water management research, monitoring and evaluation, and research management. WARD proposes to build upon past achievements of agricultural research in Cape

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Verde, move towards a more integrated approach to resource conservation, and make the best use of scarce financial, human, and physical resources.

In examining the mix of project activities and inputs that would address the projects agronomic objectives, the following criteria have been used:

1. **The rationale for continued investment in agricultural research in Cape Verde.** - Is there sufficient justification for using agricultural research as a means for increasing agricultural productivity?;

2. **The relationship of problems and constraints in the areas of agricultural research, extension, and natural resources.** -- Is the combining of agricultural research and resource conservation a logical and necessary precondition for agricultural sustainability in Cape Verde?

3. **National commitment to the goals, objectives, and concepts of promoting sustainable agriculture as envisioned through project activities.** - Is the institutional and political climate in Cape Verde conducive to full support of the WARD effort?

4. **Alternative areas of investment in agriculture for the rural sector.** - Should USAID be putting its money somewhere else?

Examination of these criteria will form the basis for recommendations for project inputs, outputs, level of assistance, and institutional objectives.

II. AGRICULTURE IN CAPE VERDE: A brief overview.

All agriculture in Cape Verde, including irrigated, is seriously limited by the lack of an abundant water supply. There are two principle seasons: the rainy season (from July to October) and the dry season (from November to June). Precipitation varies from less than 250 mm near coastal areas to more than 1400 mm on the upper ridges. Average rainfall data can be misleading, however, since spatial and temporal variations are large. Drought conditions either caused by low or poorly distributed rainfall is not uncommon.

A. Rainfed Agriculture

Rainfed farming is practiced on hillsides and ridgetops throughout the islands. On rainfed slopes, farmers plant a corn and bean intercrop. This cropping pattern accounts for more than

80% of all rainfed cropping. The most common local corn varieties used are Fogo and Maio. Farmers generally plant several different bean varieties in the same field, including common bean, cowpea, pigeon pea, dolichos, and lima beans. Although crop patterns vary slightly within the rainfed zone, most fields on slopes less than 50% are intercropped. The total estimated area cropped under rainfed conditions, by island, is given in Table 1.

The balance of rainfed cropping (approximately 20% of the total) is on hillside planting of pigeon pea and small areas of higher average rainfall where it is possible to practice a more varied agriculture. Occasionally, farmers rotate the corn-bean crop with plantings of sweet potato or peanuts. A socio-economic survey conducted on Santiago Island revealed that 22% of farmers currently produce pigeon peas (IFAD 1990). They are predominantly planted on the steepest slopes (50% and greater) at a spacing of about one meter (a spacing too wide to control erosion).

The traditional rainfed cropping cycle starts in late June or early July when farmers clear fields in anticipation of upcoming rains. All crop residue from the previous years growth is removed at this time, thus exposing large areas of soil and increasing surface runoff and erosion. Some farmers sow seed prior to the onset of rains, which generally start in mid-July. Others wait until after the first soaking rain and then immediately plant on pre-prepared fields.

Traditionally, four maize seeds are planted with a mixture of bean seeds in each hole. Seeds of traditional varieties are usually stored in containers from previous harvests and used for planting. There is periodic exchange of seed among farmers and even among islands. Few if any commercial chemical or organic fertilizers are used on rainfed fields, although there is some household livestock fertilizer available. Weeding is by hand with long-handled hoes beginning several weeks after planting (if there has been sufficient rain for germination). Weeding steep slopes requires short periods of intensive labor, usually 2-3 weeks after germination.

Yield estimates for rainfed crops vary depending on source. Even in 'good' rainfall years, however, yields are extremely low. Ministry of Rural Development and Fisheries (MDRP) survey data for rainfed crop yields, 1987-1989, is given in Table 2. Corn yields averaged from 273 kg/ha in 1989 (a poor rainfall year) to 608 kg/ha in 1987 (an 'average' rainfall year). Common bean and Congo bean production was insignificant during 1989, yet in a more normal year Congo bean yields averaged the same as corn. Yields vary greatly year to year and throughout the islands within years depending on available moisture, soil quality, cropping practice, and other factors. The following table illustrates the wide variability in corn yields on Santiago.

Zone (mm rainfall)	Corn Yields (kg/ha)		
	Hi	Med	Lo
Humid (>600)	1362	375	250
Sub-Humid (400-600)	1334	300	200
Semi-Arid (<400)	1101	250	140

In the humid zone, land is steeper and production potential is masked by land quality. On flat to gentle slopes, average yields are respectable even with current cropping practices. Most land with these characteristics is not used for bean/corn intercropping. While many recognize the hazards of rainfed intercropping on steeper slopes, few technological alternatives have been tested or proposed to farmers as a production option in order to increase yields. Cropping systems research that tests alternatives to present cultivation techniques could have a large impact on yields, while at the same time addressing sustainability issues in rainfed crop production.

B. Irrigated Agriculture

Irrigated agriculture comprises a small percentage of total cultivated land in Cape Verde but accounts for a substantial portion of total agricultural production. Table 1 gives the area of irrigated land by crop for each of the eight islands on which it is significant. Santiago and Santo Antão together account for 2498 of the 2907 (86%) hectares classified as irrigated. An estimated 30% of farm families on Santiago have some access to irrigated land with 0.1 hectare being the average plot size. It is important to note that irrigated land includes all areas where some supplemental water is available for cropping at some point in the cropping cycle, and even includes small areas behind retaining walls and other structures that have higher moisture retention than on surrounding areas. The broad classifications of irrigable land include:

- land with relatively abundant water, a mechanical means for water pumping, and a delivery system (usually plastic hosing);
- partially irrigated land with restricted quantities of and access to water, often irrigated from small canals with water controlled by the Junta de Recursos Hidricos (a governmental water resources department) or by hand from shallow, often intermittent wells;

- land upslope or adjacent to SWC structures (check dams, retention walls) with alluvial soils that retain higher moisture levels during the cropping season.

The majority of irrigated land is severely limited by water availability, and year-to-year variations in irrigated hectares results from fluctuations in ground water availability. Fully irrigated land accounts for less than 5% of total irrigated land. Water is usually pumped from tube wells and farmers have a wide choice of crops, including banana, peppers, onions, tomatoes, cabbage, and sweet potatoes. With adequate water and crop selection, farmers can crop two or even three cycles per year.

Rural surveys indicate that approximately 70% of farm families on Santiago have no access to irrigated agriculture (Finan 1989). Of the 30% that do, 93% have highly restricted use of government-controlled well water and springs. Often, these sources dry up soon after the cropping season ends. Thus, the majority of irrigated farmers are still dependent on the vagaries of rainfall.

Water which is used for partially irrigated fields is derived from either 1) hand-dug wells (pocos) which tap shallow aquifers in or adjacent to ribeira bottoms, 2) natural springs located within watersheds, or 3) small, temporary water ponding during the rainy season. Periods of moderate to prolonged drought have serious impact on water availability from shallow wells and springs and, despite supplemental irrigation, yields are highly variable due to periodic moisture stress. Crops grown on partially-irrigated fields tend to be those which can tolerate higher levels of moisture stress, such as potato, sweet potato, squash, cassava, and sugar cane. Some farmers are able to grow one high-value crop during the rainy season and, if rains are adequate, have enough water during the dry season to grow a more drought-tolerant crop.

Areas associated with SWC structures, such as alluvial soils behind check dams, constitute the third type of irrigated land in Cape Verde. They are irrigated only in the sense that soil moisture levels stay higher for longer periods of time compared to upland soils. Seventeen percent of farm families on Santiago farm some land of this type. Crops grown under these conditions include cassava, sweet potato, squash, and irish potato in addition to corn and beans.

Irrigation Management

Water is the principal limiting resource in agricultural production in Cape Verde, and water management is a key component of irrigated agricultural production. Most farmers on partially irrigated land have access to water on a set rotation schedule, managed and enforced by the JRH. Each government-subsidized well has a network of farmers receiving water. The timing and quantity

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of water is fixed by the Junta and varies widely due to fluctuations in water level at the source well. Irrigation intervals are rarely predictable and can stretch as long as six weeks during the dry season. Production parameters, such as soil type, cropping pattern, or plant growth stage are usually not considered in developing irrigation schedules. For farmers with access to spring water, the situation is less clear and varies depending upon location.

Crop beds are prepared in various sizes and configurations depending upon species planted, amount of available land, and season of growth. Farmers normally prepare level basins, up to approximately 12-15 m^2 in size, and flood irrigate when water is available. The land-water-plant density mix does not appear to be based on such factors as soil type, season of growth, or water availability. Cassava and potato are raised on beds, with ridges widely spaced from 2-5 meters in length. Farmers try to fill the basins completely during each irrigation, probably because they are never sure of when they will again receive water.

Irrigation management on Santiago does not reflect the scarcity of water as a commodity in agricultural production. The consequences of this are reflected in genrally low yields and unsustainable approaches to using water resources. Increasing water-use efficiency, balancing the crop mix to reflect water availability, and adjusting other farm practices will have a dramatic impact on irrigated agriculture productivity. In some areas, irrigated land could be increased as a result of increased water use efficiency.

C. The Role of Livestock in Agricultural Production

The ownership of livestock, including cattle, goats, pigs, poultry, and some sheep, is an important component of production systems in Cape Verde. In general, livestock production can be divided into two major sectors: family livestock in the rainfed areas and sylvo-pastoral production on arid and semi-arid rangelands.

Farmers throughout the islands use livestock as a means of wealth, income and savings. Past surveys revealed that livestock production accounts for as much as 30% of total family income, putting it at par with labor income from workfronts (estimated at 30%) and double that for rainfed farming (16%). This is despite the fact that per capita animal numbers are low (0.66 goats and 0.01 cattle. IFAD 1990) and stocking rates are low (0.13 tropical animal unit per hectare).

Over 70% of farmers own goats, which are the predominant livestock species on the islands. Due to their hardiness and adaptability to arid conditions, and preference for a large number

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of forages, goats are highly suitable to Cape Verde's conditions. But management of livestock has received little attention, and minimal animal husbandry extension has been available to farmers. CDP has performed some work on animal health in rural areas, but does not have responsibility or means for general livestock management. Given the role of livestock in household income generation, social structure and security, and their suitability to arid and semi-arid rangelands (especially in areas receiving less than 300 mm of rainfall), more emphasis on livestock research and extension should be made available.

D. Export Agriculture

Cape Verde has produced limited crops for export markets. During the mid-1960s, banana exports from Santiago, São Antão, and São Nicolau were significant. The state-run irrigated farm in Santa Cruz (Santiago) still exports bananas to Portugal. However, total exports have declined as other countries vie for the same markets. Cape Verde bananas have poor shipping quality, often arriving in Portugal as sub-standard produce. Their acceptability on other foreign markets would be minimal. Some coffee bean production is supported by Portugal. Beans resistent to a coffee rust are produced on Santiago and then shipped to Lisbon.

Given the inefficiencies associated with irrigated agriculture, the relatively small amount of land under irrigated production, and the need to service local markets, it does not appear advantageous at this time to invest scarce project funds into supporting export production. Prices for irrigated crops are attractive in Cape Verde, and the value of irrigated land is extremely high. Satisfying local demand is a reasonable near-term goal. WARD can, however, improve export potential in Cape Verde by improving water-use efficiency, crop mix, and other cultural practices which will increase crop productivity. Until then, it is doubtful that farmers can overcome constraints such as inferior product quality, high transportation costs, and uncertain transportation scheduling.

E. Technology Transfer

During the Food Crop Research Project, the purpose of U.S. assistance was to increase INIA's institutional capacity to conduct applied research on a variety of food crops, both irrigated and rainfed. The project stopped short of proposing to bridge the technology transfer gap between agricultural research and extension. This was justified on the grounds that there was not a viable extension service with which to work early on in the project. The WARD project begins under different conditions.

- A national extension service (DGER) was created in 1985, under the direction of the Ministry of Rural Development

and Fisheries. It was supported, in part, by Belgium, FAO, and the Netherlands.

- DGER has trained extensionists on Santiago, four of which are working in Ribeira Seca.

- Training facilities are available at São Jorge for extension personnel, and several agents have recently completed two-year coursework.

- The DGER recognizes that cooperation among research, extension, and other GOCV agencies is essential and is eager to participate in on-farm trials, demonstrations, and other aspects of technology transfer.

- The research-extension link can be partially addressed through joint programming in on-farm trials and other activities of research.

The extension service is young and under-trained, and it would be unrealistic for WARD to propose a major investment in extension. It would, however, be advantageous to train some extension workers to work in the target watershed, to participate in on-farm trials with INIA, and to perform extension-level services in surrounding sub-watersheds as part of their normal extension functions.

III. AGRICULTURAL RESEARCH IN CAPE VERDE

A. INIA Research Programs and Strategy

INIA was founded in 1978 (then called the Center for Agrarian Studies) on the site of a former colonial experiment station/boarding school. The station, located in Ribeira Seca at São Jorge dos Orgaos, comprises 52 hectares and is 29 kilometers from Praia. INIA is a semi-autonomous organization currently under the MDRP. Under the new government organization, it will be placed in the Institute of Rural Development along with the National Extension Service (DGER) and other agencies.

Research Priorities

INIA's research programming and priorities are defined under the Third National Development Plan elaborated in 1989. To date, this document has not been significantly amended and is still the strategy under which INIA carries out its research mandate.

INIA's research program focuses on the following areas:

- improving the utilization of Cape Verde's soil and water

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resources and promoting their preservation and regulation;

- intensifying irrigated and rainfed crop production to encourage food self-sufficiency in locally grown crops (with the exception of grains);

- reinforcing livestock activities;

- increasing technical scientific and professional capabilities of research and technical staff;

- maintaining and protecting the natural physical environment; and

- accelerating a dialogue with rural populations.

INIA's research strategy for addressing these needs is as follows:

- promoting sustainable production systems based on 1) the measurement of physical, chemical, biological, and socio-economic elements of the resource base, 2) the awareness of the determinants of stability and degradation (e.g. - soil erosion), and 3) the efficient design of resource management systems.

- intensifying agricultural production through the use of locally adapted species and determining appropriate cultural and cropping systems management practices for achieving higher productivity per unit of land and water;

- developing improved storage, marketing, and use of agricultural products;

- developing production alternatives on marginal cropping lands;

- increasing livestock productivity and animal products quality through better animal health and nutrition.

- improving traditional irrigation systems and introducing more efficient water delivery systems; and

- establishing socioeconomic baseline data and periodic benchmarks for rural Cape Verde.

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Related to INIA's goals and strategy is a stated commitment for further development opf human resources through training, salary incentives, and career motivation. The need for collaborative research, not only among INIA and other Cape Verde personnel, but with International Agricultural Research Centers (IARC's), African national research centers, and U.S. universities is also recognized.

INIA is a small institution with a limited capability to conduct a broad-based research program. Strategies listed above are all important priorities on the national agenda for agriculture. However, some sustainable level of research programming, infrastructure, and funding to support a modest level of research must be arrived at in the near future. To date, no serious effort has been made to match national priorities with available and foreseeable resources. The newly installed government appears amenable to streamlining services and focusing only on the highest priorities. Planned realignment of institutions to make them more autonomous and more professional in terms of hiring and dismissing staff is encouraging.

WARD technical assistance should address INIA management needs early in implementation and help program for decreased assistance during the latter years of the project. This weaning process will allow an orderly turnover to INIA of TA responsibilities and help avoid shock waves that sudden departure of staff and funds often causes.

Organizational Structure

INIA's organizational structure is detailed in Figure 1. The institute is led by a President (currently Antonio Sabino) and a Director of Research (Carlos Silva).

A Coordinating Council, overseen by the Minister of Rural Development, insures a dialog among the various ministerial departments in matters concerning policy and programming of technical and scientific activities. The Council reviews and approves INIA's research objectives, budget, and annual reports. It meets twice annually, once in January to approve the budget and again mid-year to review annual reports.

The Scientific Council is composed of the INIA president, research director, training director, and department heads. It frequently invites research staff to attend meetings, but does not grant them voting rights. This Council reviews internal problems of coordination, work plans, training plans, etc. Each researcher outlines her/his research program. These are passed to the Director of Research who, after consultation, approves them or makes recommendations.

Institutional Resources

Physical - INIA has a complex of offices at São Jorge, including a main building with individual offices for research staff, auxiliary office space, a soils and water analysis laboratory, a biological pest management facility, garage, cafeteria, and houses for several staff and expatriate researchers. INIA does not suffer from a lack of physical infrastructure, although its program of maintenance is not rigorous. There is a shortage of vehicles for research and support staff. Eight of ten vehicles are in running condition. Spare parts should be made available and additional forms of transportation ordered under the new project.[1] The resident mechanic keeps vehicles in good working order despite a serious shortage of spare parts.

Financial - INIA's financial resources are derived from the GOCV general budget and from donor financing. The following is a 1989 breakdown of these resources (in USD 000):

Source	Amount	Percent
GOCV	653	28.9
DONORS	1,610	71.1
TOTAL	2,263	100.0

External donor inputs include equipment and supplies, direct support to research, salaries of expatriate technical staff, etc. GOCV financing is divided into two parts: 45 percent (298) goes to operations and staff salaries, and 55 percent (355) as counterpart funds to donor financed projects (which includes salaries of technicians, drivers, field workers, etc.). Government support to INIA in 1990 amounted to 2.25 percent of GDP attributed to agriculture. The GOCV commitment to funding INIA appears solid. Under FCRP, the GOCV contributions to research increased 169% between 1988 and 1990, and another 10% increase was anticipated for 1991.

Human - INIA has a staff of 46 employees: a cadre of 22 well-trained researchers, many of whom have received some education in the U.S.; 17 mid-level technicians; and 7 administrative workers. In addition, there are temporary hires for field labor and data collection. Table 3 is a current INIA research staff list.

Despite the number of qualified researchers, INIA is deficient in a number of key positions, including irrigation and watershed

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[1] USAID and the contractor should consider bringing vehicles in under IT plates until the end of the project. This would keep vehicles under project control until the PACD.

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management, agricultural economics, agroforestry, and hydrology. Mid-level staff training is also deficient. Short-term training and upgrading of skills of current scientific, technical, and administrative staff is an important incentive for INIA staff.

IV. Defining WARD Assistance to Priority Problems in Cape Verde Agriculture

A. Results under the FCR Project

Although U.S. support to national agricultural research dates back to 1974, the most recent project activity was the USAID/University of Arizona Food Crop Research Project (FCRP) which began in-country activities in 1984. The goal of FCRP was to support the GOCV's efforts in food self-sufficiency and rural employment, income, and nutrition. Its purpose was to increase INIA's impact on food production through the promotion of adaptive research. FCRP focused on institutional support, training, and initiation of pilot research activities in basic dryland and irrigated crops and increased INIA's capacity to conduct adaptive research.

The project was successful in terms of meeting its basic outputs in applied research, training, and institutional support. It benefitted from a highly dedicated technical assistance team (the agronomist stayed in country, living at the INIA research station, for over five years) and a cadre of motivated trainees, the majority of whom are now researchers. There were some valuable lessons learned, however, that should be factored into future collaboration with INIA.

- Several of the returning trainees had trouble readjusting after returning to INIA. Some of the problems were caused by insecurities resulting from a lack of experience and from the high expectations placed upon them immediately after returning. They suffered from a lack of individual guidance and direction in their research programs. This problem needs to be addressed in the training plan under WARD to ensure that returning researchers (past and present) are given proper guidance.

- The number of INIA staff sent for long-term degree training overwhelmed the capabilities of technical advisors and INIA administrators to set research agendas and priorities. More attention should be given to carefully matching institutional needs with long-term training. This implies 'looking into the future' to envision what INIA will be focusing on over future planning horizons.

- The FCRP focused on adaptive research and varietal trials to increase agricultural productivity and INIA institutional capability. This work continues, but varietal improvement should be complemented by increasing water-use efficiency through adaptive cropping systems and water management research.

B. The Use of Technical Assistance

WARD project activities should be programmed with explicit linking among technical assistance, training, and institutional support components. The basic thrust of technical assistance under the project should be to provide qualified personnel on a short-, recurring-, or long-term schedule and based on the following principles and objectives:

- work with researchers of several disciplines (some of which may be out of the T.A.'s specific field) and provide guidance to young research staff;

- accept flexible programming and a wide range of duties, not all of which will be technical in nature;

- conduct limited fieldwork but emphasize the provision of training to researchers in research management areas such as experimental design, prioritizing of research activities, analysis of data, reporting of results, and research-extension linkages.

The WARD project will need technical assistance personnel with particular skills and backgrounds, based on the following general guidelines:

- professional skills and experience in more than one area of agricultural research, preferably in part related to watershed development;

- affiliation with a university or other public or private research firm for at least five years;

- experience in all phases of adaptive, on-farm research, including multidisciplinary research design, farm-based research trials, data analysis, and publishing;

- sensitive to the linkage between research and extension, and a demonstrated ability to work with extension personnel in preparing extension-related materials.

C. Evaluating the Criteria WARD Activities in Agricultural

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Research

The Rationale for Continued Investment in Agricultural Research.

Although Cape Verde is a small country, several important factors justify a continued commitment and investment in the agricultural sector.

- Cape Verde is an isolated country, located 650 kilometers offshore of its closest neighbor, Senegal. This creates problems related to the supply and cost of agricultural inputs, the transfer of information, seed stocks, and inputs from adjacent markets, and the possibilities for export to and from other countries.

- Climatic and edaphic conditions in Cape Verde differ widely from other Sahelian countries. Although rainfall regimes are similar, the elevational gradients, slope and soil characteristics, and problems of water delivery all influence research priorities.

- Cropping practices and food preferences differ widely from other Sahelian countries.

- Cape Verde has an intricate link between crop and livestock production and natural resource protection and enhancement. The fragile resource base necessitates that efforts to increase agricultural productivity not be developed in isolation of the special problems posed by environmental factors. Finding a sustainable level of productivity which makes efficient use of water with appropriate cropping practices should be given priority in research.

INIA has developed an impressive research capability in its short tenure as an institute. It has a highly educated and motivated staff that is results-oriented and productive in spite of resource constraints. The most compelling need, however, is guidance by experienced professionals who can orient them in their research programs.

The Relationship of Problems and Constraints in Agricultural Research, Extension, and Natural Resources.

A number of documents addressing agricultural production and soil and water conservation in Cape Verde, including GOCV planning papers, donor-assisted project papers, and academic-style reviews, have all expressed similar views and conclusions related to the future of the rural sector in Cape Verde. The resource base is

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such that production on most rainfed land currently farmed in Cape Verde should be drastically reduced in order to reverse soil and water conservation problems. However, the reality of the problem - in that we are dealing with human livelihoods and the needs of rural farmers who have few alternatives for generating income - dictates to a large degree the alternatives.

There is increasing recognition that the link between agricultural research and natural resource protection is the key to addressing production problems in Cape Verde. Whether framed in the context of 'sustainable agriculture' or the use of 'limited resources', the evolution of this linkage is in an operational sense vital to Cape Verde's future. WARD appears to be timely for shaping the outcome of this newfound awareness. The priority problems as seen by the GOCV, its implicated institutions, and by the donor community - resource protection, efficient use of scarce resources, impact monitoring (both positive and negative), and prudent investment in human resources - are all in agreement with those set out in the WARD project design.

National Commitment to the Goals, Objectives, and Concepts of Promoting Sustainable Agriculture as Envisioned Through Project Activities.

The government has set out on an ambitious agenda to improve the quality of life for rural Cape Verdeans. It envisions the creation of more income-generating opportunities based on increased agricultural production, rural enterprise, and artisinal activity. The GOCV is embarking on a long-term effort, and are only now formulating a plan for moving in this direction.

National goals with respect to the agricultural sector closely parallel the assumptions and prospects upon which the WARD project is based. The GOCV has increased its investment in agricultural research steadily over the past decade, and is committed to expanding the role of extension.

Alternative Areas of Investment in Agriculture for the Rural Sector.

There is a myriad of activities that constitute justifiable investments in the rural agricultural sector: credit to farmers, sylvo-pastoralism, pest management, etc. The WARD project focuses on several, including water management, on-farm research, and monitoring/evaluation of interventions. The urgent need for applied research on water management and cropping systems, along with the value of on-farm research, makes this particular focus pertinent.

Effective soil and water management is the key to sustainable

agriculture in Cape Verde. Research in this area has lagged far behind crop variety and pest management improvements. While the number of research topics that INIA can be expected to administer is limited, they need to be competent and productive in research on their most precious two resources. No other donor has stepped forward to address these needs. Indeed, no other donor has access to the resources in the U.S. - both university and private -for such assistance.

Investment in on-farm research is also warranted. Given the limitations of present and future research resources in Cape Verde, nobody can afford to conduct research on problems not directly relevant to farmers. On-farm research is a methodology that all applied research institutions such as INIA should be utilizing.

C. Priority Project Components

Overview of Agricultural Activities

In order to increase sustainable agricultural productivity, INIA needs to strengthen it research program in the following areas:

- Cropping Systems and Water Management Research - This should include research on water-use efficiency, crop manipulations for efficient water use, soil management for water conservation, irrigation options to avoid critical stress, and cropping (cultural) practices for irrigated and rainfed fields.

- On-farm Research - As a means for testing technology on farmers' fields, with participation of farmers and extension. This component would include both current and future research themes developed under the project.

- Varietal Improvement - To continue past investments under the FCR project on promising varieties adapted for the agro-ecological zones of Cape Verde. Materials from current research would be first available for on-farm trials. A new component of this work would be in identifying forage species appropriate for conditions in rainfed and irrigated cropping zones.

- Monitoring and Evaluation - To judge the impact of research and infrastructure development for natural resources on agricultural productivity and on human well-being.

- Research Management - To assist INIA in setting appropriate research agendas and targets, and to improve its operations.

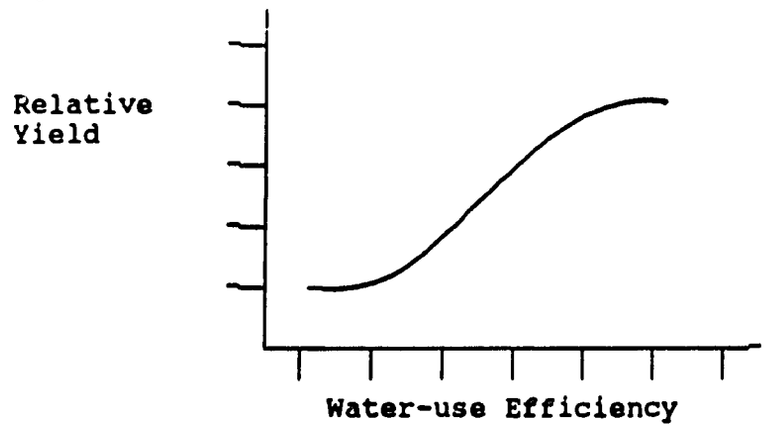
These represent areas where close collaboration between research, extension, and rural engineering are most feasible and where previous effort and investment in INIA can continue.

C1. Cropping Systems and Water Management Research

Problem

Where water supply is limited, several cropping strategies are available for optimizing water use and assuring a more sustainable farming system. These strategies include: maximizing the amount of available water that is conserved and made available for plant growth; achieving a high level of production per unit of transpiration; and balancing cropping patterns between seasonal water use and supply. Cape Verde's choice in strategy is limited by seasonal water availability and conserving water is a key to a sustainable level of productivity. However, although water supply is a major factor in crop yields, crop management is the leading cause of inefficiencies in water use. In a landmark irrigation study, Ackermann et al. (1978) concluded that 59% of irrigation water is loss from storage and conveyance and, therefore, unavailable for crop growth. Cape Verde doesn't have surface storage and transport problems of this magnitude, but water is the scarcest crop production resource on the islands and, as such, it must be properly managed.

The relation of water use to crop yield is well known and illustrated by the following graph. At lower levels of water use, plant growth is severely restricted. Many crops survive vegetatively but do not produce a viable crop. At intermediate water uses, small differences in water use efficiency have profound impact on crop yield. At high levels of water use, plants are able to satisfy their water requirements and changes in use are not reflected in increased yield. Given the cropping practices currently in use throughout much of the island, it is fair to say that water use efficiency is extremely low. Several key cropping system and water management techniques are not being put into practice on irrigated and rainfed fields in Cape Verde and changes in crop practices can result in yield increases of several magnitudes.



An illustration of water use relations discussed above is available from a simple research trial conducted at INIA. In a study evaluating the impact of gully control structures, Sabino (1991) found that corn yield was significantly higher on rainfed fields behind check dams and gully plugs. Sediment which accumulates behind these structures store more water during the growing season, and this small change in water availability contributes to increased productivity. In sub-humid zones, yields averaged 1,641 kg/ha behind structures compared to 576 kg/ha on adjacent fields.

Adaptive research on cropping systems and water management in Cape Verde should focus on several topics. Soil management for efficient water use should be a priority. For example, mulch management to reduce soil water loss is a logical cropping practice for irrigated fields in Cape Verde. Mulches can help retain soil moisture, decrease wind and water erosion on fields, and increase yields. Some innovative techniques in mulch management are in use in other arid countries. In the Canary Islands, cinder mulch made from locally available black volcanic rock is ground and spread on vegetable fields, serving as an evaporation suppressant. Biodegradable plastic-coated paper mulches have been used to increase cantaloupe yields by 123%.

Other management practices, including proper irrigation timing, plant density, crop associations, contour cropping, and plant mix can all increase productivity by increasing water-use efficiency.

Research activities in cropping systems and water management will target both irrigated and rainfed agriculture.[2] The management alternatives which optimize water use will be different on the two systems, but there is large potential benefit to conserve scarce water resources and provide a more sustainable agricultural production base.

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[2] The WARD project makes use of a flexible definition of irrigated agriculture to coincide with the concept as it exists in Cape Verde. In general, the project will focus its support on farmers with no or only limited access to irrigation, where great strides can be made in improving the efficiency of applied water, expanding areas where soil moisture can be retained, and improving irrigation cropping methods to maximize use of available water.

Constraints

INIA faces several institutional constraints to conducting cropping systems research, none of which are too serious to exclude as a project activity. First, there needs to be some emphasis given to increasing the experience of current and future trained researchers. Currently INIA does not have an agronomist with the experience or qualifications to lead a research program in cropping systems.

The most qualified researcher at INIA to conduct studies on irrigation and water use in Antonio Sabino. He is also the President of the Institute, so his research time is taken up partly by administrative duties. There is no specialist trained specifically in irrigation and water management or agronomy with experience in cropping systems research.

There is a need for diagnostic studies to help determine an agenda for cropping systems research. Such research often makes use of multidisciplinary teams and relies heavily on cooperation and input from social scientists and economists in order to validate the proposed research. Given the few social scientists available at INIA, research priorities must be carefully set and planned through coordination with other project activities.

There is also a problem of too much to do. Since cropping systems research touches all phases of agricultural activity, the number of research topics, all seemingly relevant and high priority, can easily overtax a small research agency.

WARD Activities

WARD will assist in building INIA's capacity to conduct applied cropping systems research through selected research activities in the targeted watershed, well-planned short and long-term training activities, and technical assistance. Specific WARD activities in cropping systems research over the LOP should be in the following areas:

- Water Management Research - Irrigation management, water-use efficiency, fertilizer-water response, water harvesting, drip irrigation, and cultural practices (e.g. - crop mix) under irrigated conditions.

- Cropping Systems - A variety of cropping systems topics should be included in research. On rainfed cropping systems, methods such as contour tilling, hedgerow agroforestry, stripcropping, and terracing can have a major impact on preventing soil loss and increasing production. The constraints to introducing such technologies in Cape Verde may be significant. This type

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of research should be initiated by socio-economic data on farmer receptivity and through multi-disciplinary on-farm research. Results could take several years to achieve given the high rainfall variability and the propensity for general crop failure on rainfed slopes. Add to this the gestation period required for many agroforestry initiatives before visible results.

Topics such as modification of tillage (e.g. -1) contour tillage to increase surface storage and slow overland flow and 2) planting corn in small basins about 20cm deep on a rim would decrease soil loss - Norton, Report: Soil Erosion Modeling, Sheladia Associates, Inc. 1986), crop mix on irrigated land, bed preparation, mulching, and optimal plant spacing should also be considered.

Rationale

The rationale for investing project resources in cropping systems is the large potential impact of agricultural production and the institutional assistance the INIA needs in this area. U.S. technical assistance is exceptionally strong in this area and no other donor has the access to resources that USAID does. The WARD project should have significant impact on agricultural production with only modest levels of soil and water management improvements.

C2. On-Farm Research

On-farm research is not a specific research activity per se. Rather, it is a methodology and an approach that is particularly relevant to agricultural development. It is treated here as a project focus in order to place emphasis on its importance, keep it in the forefront of project objectives and activities, and show how it is used to bring together research disciplines, both technical and socio-economic.

Problem

Resources with which to carry out agricultural research are scarce, especially in a country the size of Cape Verde. There is a real need to focus on research that is relevant to farmers' needs while at the same time addressing priority problems of soil and water conservation.

As a research institute, INIA has performed admirably, given the technical constraints and funding limitations under which it operates. The research agenda, however, has not been formulated from the perspective of the needs of rural farmers. This is not to say that relevant research has not taken place. But farmer participation has not been given high priority.

Recently, more researchers have conducted on-farm trials for

testing varieties adapted to the various agro-ecological zones of Cape Verde. As adapted varieties are identified, there is always a need to conduct performance trials off-station. On-farm research involves more than just using farmers' fields as testing grounds. Its real values are 1) forging the research-extension linkage by providing the opportunity for research and extension personnel to work together on common problems, 2) introducing interdisciplinary approaches which bring several technical areas together to work on common problems, thus providing important socioeconomic input into agricultural research, and 3) providing a means for gaining farmer feedback on technology acceptance early on in the research process.

Constraints

On-farm research methodology is not a panacea. It is a tool or approach and, like all other tools, must be used properly to be effective. One of the normal constraints to institutionalizing the use of on-farm research is to get people to work together. It is often too easy for a researcher to head off into her/his own agenda (especially when that person is the resident 'expert' in a particular field and is never challenged intellectually by peers). Conducting on-farm research requires coordination in planning, implementing, and evaluating research. The problems which must be addressed in increasing INIA's capacity to conduct effective on-farm research include upgrading skills in research planning, experimental design and field layout, analysis of socio-economic constraints and opportunities, and incorporating the needs of extension into research.

WARD Activities

WARD activities will be initiated with a series of short-term training in Cape Verde by highly experienced field researchers. Extension personnel will be given supplementary training to bring their skill levels up. An agreement between INIA and DGER may be necessary in order to engage the full participation of research and extension personnel.

The first farm-level activities should team technical assistance, INIA researchers, and extension personnel in testing adaptive technology that INIA has ready. Areas of research which could be explored early in project implementation include potato storage, drip irrigation, sweet potato and cassava variety trials, bean variety trials, and tomato trials. On-farm research methodology will not be restricted to irrigated fields, but emphasis will be placed on activities in the targeted watershed in order to take concentrate project activities and take advantage of other work in the same area (e.g. - socio-economic surveys).

Activities which will depend on the return of trainees and/or on the formulation of new research plans, but for which on-farm testing will still be a critical component, include such areas as

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forage, watershed management related to structures built under the project, irrigation management, water harvesting, and cropping practices.

Rationale

There are three main rationales for investing AID resources in on-farm research methodology for INIA. First, it is a logical extension of activities initiated under the FCRP in strengthening INIA's institutional capacity for conducting research. Now that a critical mass of researchers working in several disciplines has returned from training, it is an ideal time to start multi-disciplinary research.

Second, there is a critical need in Cape Verde to engage extension in trials on farmers fields. Extension workers will receive in-country training that will include concepts of on-farm research. They will work with researchers in on-farm trials. This research-extension linkage will be critical for helping extension agents diffuse technology to other farmers.

Third, INIA is a small research institution (and should stay small for the foreseeable future) and must focus on a few of the most relevant research topics. Ignoring on-farm research would increase the risk that years of topical research was wasted on crops or methodologies not adaptable by Cape Verdean farmers.

Several short-term training courses in Cape Verde will be required, including on-farm research methodology, social science research methods, Farming Systems methods training, and training for extension personnel who will be seconded for project activities. The project should also considering 2-3 day training at the Training Center for a representative group of farmers from the target watershed. This training could cover such items as: the value and objectives of resource conservation, farmer participation in on-farm trials, the role of extension, and a sketch of the WARD project. It could also provide a forum for farmers to discuss what their production problems are.

C3. Monitoring and Evaluation

Problem

Cape Verde needs a means of monitoring and evaluating the impact of its programs in resource conservation and agricultural research on the production at the farm level. At present, the results of interventions designed to stabilize the resource base are poorly understood. In terms of resource sustainability and fiscal responsibility, Cape Verde can ill-afford to invest scarce resources in developing large infrastructure that does not pay off in resource conservation and does not impact agricultural production. The same applies to agricultural research, and INIA

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needs some method of feedback in order to keeps its research program focused.

Constraints

Developing a capable monitoring and evaluation program will require designation of personnel, periodic training and updates, and an institutional awareness of how to interpret and utilize data collected from the monitoring and evaluation program. INIA and DGCSFER management will have to be committed to the concept and see this component as something necessary, not just a wild idea.

WARD Activities

WARD will develop INIA's capacity to monitor and evaluate impacts of activities aimed at increasing agricultural productivity. Cape Verde is in great need of the capacity to measure and analyze the effectiveness of its conservation and research programs. Without this capacity, forward planning is grounded on unreliable assumptions and risks wasting scarce resources.

Technical assistance will work with INIA researchers and DGCSAFER personnel to develop a sustainable monitoring and evaluation (M&E) capability. This capability will be housed at INIA where it can profit from research facilities. In addition, INIA has the supporting infrastructure (soils and water analysis lab, computer facilities, and a socioeconomic department) necessary for data collection and analysis. Initial activities will include:

a) a rapid, comprehensive review of the effectiveness of soil and water conservation structures on Santiago Island;

b) a quantification of impact area and land under cultivation as a result of SWC structures using on-ground survey work and available aerial photography;

c) a measurement of the structural soundness of dams and other structures; and,

d) analysis of soil evolution behind check dams and associated crop yields.

e) a socioeconomic baseline study of the target area that captures the start-up status of key indicators (both quantitative and qualitative, objective and subjective) of project impacts, to be tracked throughout the LOP. This baseline study will be preceded by a thorough review, analysis, and reporting on existing socioeconomic literature on agricultural families of Santiago.

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Establishing and institutionalizing and efficient monitoring and evaluation program will require several years and repeated services of technical advisors. The programs to be established should not be highl· technical in nature, especially in the beginning. As more e).perience is gained, more sophisticated means of measurement and analysis can be explored. However, initially the methods should remain as simple as possible.

Rationale

Monitoring and evaluation enables efficient programming of scarce resources. Once there is an effective capability in place, it can influence how research and development priorities are set by providing objective data. It can also influence policy makers by demonstrating the effectiveness of various programs.

C4. Research Management

Problem

INIA is still a young research institute with only limited experience in management and administration of programs. Despite its youth, it possesses a motivated staff and a program focused on relevant agricultural development problems. But resources are and will in the foreseeable future be limited. In order to reach a sustainable level of research programming and budgeting, INIA needs to continue to improve the management of its limited human, financial, and physical resources.

Research planning can be strengthened by a more systematic approach to agricultural problems and by a closer collaboration with other GOCV institutions, such as extension and rural development agencies. Training which provides managers with organizational skills would also have a large impact.

Constraints

INIA is a well-managed institution, a result of hard work by its management and administrative staff. Like any institute or business, however, there is always room for improvement. The major constraint is that administrative tasks are assumed by researchers who retain scientific responsibilities and, in some cases, have limited experience administering programs. This is necessary due to the limited staff size and the constraints present for expanding beyond its current size.

WARD Activities

Services under the WARD project will include:

- strengthening research planning by providing assistance in defining research objectives, based on an analysis of constraints to agricultural production in Cape Verde;

- improving the skills of mid-level technicians and administrators;

- providing researchers and administrators with skills in proposal writing, contracting, priority-setting, and other subjects relevant to their particular fields;

- providing assistance in financial management, business practices, and inventory control.

Rationale

Continued investment in the institutional strengthening of INIA will facilitate progress in other areas of the project. Most importantly, it will help to ensure that priority research problems continue to be addressed and that INIA support to activities supported under the project is efficient and timely. It will also help INIA through the transition phase of the new government, where some broad changes are expected to soon be implemented.

C5. Varietal Development

Problem

Agricultural research involves a continual search for new varieties adapted to local conditions and acceptable to farmers. In a sense, the work is never done because time brings on new problems and new genetic material to test. Under the FCRP, much of the research emphasis was placed on identifying crop varieties adapted to agro-ecological zones found in Cape Verde. This work continues to date, with and without donor assistance. The WARD project will start with the momentum and progress made under the previous project, and target varietal development in concert with other activities in watershed development.

WARD Activities

WARD activities in varietal development will include peripheral varietal improvement work in the following areas:

- Root and tuber crops

- Forage crops

- Dryland crops for addressing soil erosion problems

- Irrigated horticultural crops

The majority of this work will not require extensive project overhead in the form of technical assistance since some of the work is on-going and was fostered under previous FCRP activities. There should be, however, emphasis in the target watershed for testing forage species and crop-shrub-tree combinations for livestock browse and soil conservation.

Rationale

Continued investment in varietal improvement will complement watershed activities under the project, capitalize on previous gains under the FCR project, and provide material for increasing the productivity of agriculture in Cape Verde. It will also provide more appropriate technology to be tested on-farm with extension and disseminated to farmers.

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Table 1 -- Total area for rainfed and irrigated crops - Cape Verde Islands.

Island	AREA TOTAL (HA)			AREA CULTIVATED 87/88 (HA)			Percent Total	
	Irr.	Rainfed	Total	Irr.	Rainfed	Total	IR	RF
FOGO	12	5989	6001	12	5730	5742	100	96
SÃO NICOLAU	9	191	200	69	1806	1875	77	94
SÃO Antão	1574	7568	9142	1357	6401	7758	86	85
Porto Novo	457	3062	3519	298	2425	2723	65	79
Paul	429	1140	1569	402	1027	1429	94	90
R. Grande	688	3366	4054	657	2948	3605	96	88
SANTIAGO	924	20728	21652	677	20155	20832	73	97
Praia	213	3694	3907	160	3286	3446	75	89
Santa Cruz	244	3989	4233	228	3937	4165	93	99
Tarrafal	131	6025	6156	130	5979	6109	99	99
S Catarina	336	7020	7356	160	6952	711	48	99
BRAVA	27	1102	1129	25	1042	1067	93	95
MAIO	36	636	672	14	392	406	38	62
BOA VISTA	8	493	501	6	469	475	79	95
SÃO VICENTE	314	182	496	60	91	151	19	50
SAL	3	242	245	2	215	217	96	89
TOTAL:	2907	37131	40038	2222	36301	38523	76	98

Source: Agricultural Reconnaissance Survey, MDRP, GEP, Statistics Division Government of Cape Verde, 1988 (Jan. 1990)

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Table 2 - Average Yields for Rainfed Crops, 1987-1989.

Island	CORN			KGS/HECTARE BEANS			CONGO BEANS		
	1987	1988	1989	1987	1988	1989	1987	1988	1989
FOGO	853	297	260	334	194	141	600	238	8
SÃO NICOLAU	731	269	265	150	178	70	..	385	146
SÃO Antão	93	112	532	..	..	0	500	..	0
SANTIAGO	672	635	175	327	423	31	..	..	13
Praia	557	519	102	273	420	12	..	..	0
Santa Cruz	651	693	212	400	317	57	..	..	9
Tarrafal	820	722	168	400	661	0	..	..	0
S Catarina	646	549	173	350	372	29	..	..	42
BRAVA	1050	933	911	444	132	108	600	..	0
MAIO	382	444	200	128	..	0	..	..	..
BOA VISTA	286	..	..	250	..	..	500	..	..
SÃO VICENTE	..	..	..	..	..	..	..	..	..
SAL	..	..	..	..	..	..	..	..	..
AVERAGE ALL ISLANDS	608	482	273	299	310	53	571	203	13

Source: MDRP, GEP, Statistics Division
Government of Cape Verde (August 1990)

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Table 3 — INIA Research Staff

INIA Staff - 1990			
Specialization	Name	Program	Degree Equivalent
Agronomy	C. Silva	Rainfed Agric.	**[1]
Agronomy	H.L. Lima	Pest Management	**
Hydrology	A. Sabino	Water Harvesting	Masters
Plant Breeding	M.I. Andrade	Tuber Crops	Ph.D. (return 1992)
Horticulture	J. Levy	Vegetable Crops	Ph.D. (return 1992)
Agronomy	N. Silva	Food Legumes	**
Agronomy	J.M. Barbosa	Banana, Sugar Cane	**
Plant Pathology	A.M. Lima	Pest Management	Bachelors
Agronomy	E. Fortes	Pest Management	Bachelors
Agronomy	J.M. Brito	Pest Management	Bachelors
Agronomy	F. Delgado	Pest Management	Bachelors
Soils	J.S. Brito	Soil Studies	Ph.D.
Soils	I. Baptista	Soil Studies	Bachelors
Agronomy	R. Amores	Soil Studies	**
Agroclimatology	L. Alus	Soil/Water/Plants	Ph.D. (in training)
Botany	I. Gomes	Herbarium	**
Range Science	MT Vera-Cruz	Pasture/Forage	Masters
Sociology	E. Coutinho	Social Studies	**
Agronomy	O. Cruz	Training Center	**
Training	G. Silva	Training center	**
Documentation	I. Fernandez	Document Center	Bachelors
Technical Staff			
Agroclimatology	seven	AGRHYMET	Masters (2)
Hydrology	one		
Manutation	three		
Soils Lab	one		
Rainfed Agr	one		
Seed Production	one	Coffee	
Documentation	one		
Botany	one		
Computers	one		
Pest Management	one	Grasshopper/Locust	

[1] Indicates a degree other than a U.S. university-offered Bachelors.

Ackermann, W.C., D.J. Allee, J. Amorocho, Y.Y. Haimes, W.A. Hall, R.A. Meserve, R. Patrick, and P.M. Smith. 1978. Scientific and technological considerations in water resources policy. EOS Trans. Am. Geophys. Union 59:516-527.

TECHNICAL ANALYSIS

OF

SOIL AND WATER CONSERVATION

This annex analyses soil and water conservation activities proposed for Cape Verde's Watershed and Applied Research Development Project (WARD). It is based on information contained in the Project Identification Document (PID), the final evaluations of USAID's Food Crops Research Project (655-0011) and Watershed Development Project (655-0013), field observations and interviews, and perceived needs expressed by government officials. It contains three principal sections: a discussion of soil and water resources in Cape Verde; a review and analysis of activities implemented by the preceding watershed development project to conserve and manage those resources; and a description of soil and water conservation activities of WARD -- their objectives, activities, and impacts.

SOIL AND WATER RESOURCES OF CAPE VERDE

General landscape

Cape Verde, a nation of ten desert islands, lies 650 km off the coast of Senegal. Although WARD addresses institution building activities that affect each of Cape Verde's inhabited islands, it concentrates its soil and water resource conservation activities in Ribiera Seca watershed on Santiago Island 20 km north of Praia, Cape Verde's capital. As part of its activities, WARD will also rehabilitate and upgrade existing hydraulic structures in other watersheds. Santiago Island is dominated by steep, barren slopes occupied by hillslope farming and livestock raising; irrigated agriculture is limited to narrow fluvial terraces in the lower watersheds, often in close proximity to the sea. Low rainfall, high temperatures, and nearly constant wind combine to create an arid climate. Mean annual rainfall varies from less than 150 mm near the coast to about 900 mm at upland summits. Mean temperature also varies with altitude, ranging from 25 degrees Celsius in the lowlands to 18 degrees in the uplands. High temperatures and other conditions create levels of potential evapotranspiration that, depending on location, exceed annual rainfall by 3 to 10 times. Water-supply deficits of this

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magnitude mean that dry season supplies of soil moisture are adequate only for drought resistant perennials. Streamflows are ephemeral, occurring only during the rainy season.

Santigo Island is volcanic in origin, containing both crystalline basalts and lava. Crystalline basalts dominate the central core of the island where their massive structure offers little potential for groundwater development (personal communication, Junto dos Recoursos Hidricos (JRH)). Much of this material is overlain by pyroclastic, cindery ejecta and weathered rock. Volcanic plugs, basalt ridges, lava plains and plateaux dominate the landscape -- Santiago Island's highest altitude is 1394 m. Ridge crests of exposed basalt separate steep, V-shaped canyons. Where weathering and erosion have caused the original basalt to totally disappear, the remaining soil forms knife-edged summits. Upland slopes are linear and steep, often about 70 percent. Colluvial material from these slopes often collects in lowland drainages, providing a transition zone of sloping land which, near the channel margin, forms flat, fluvial terraces.

Surface erosion is principally of colloidal and fine soil materials, most of which find their way to the sea; bank erosion, land slides, gullying and other processes provide coarse material (silaceous sands, gravels and cobbles) directly into channels where much of it remains resident. Floods often redistribute channel materials to create a convex cross-channel profile. This forces low flows along the channel border where they undercut banks, leading to their eventual collapse and adding new bed material to the stream.

Santiago Island's soil resources reflect its geology and climate. Upland basalt weathers rapidly into shallow Inceptisols; their principle constraints to exploitation are shallow depth, aridity, infertility and high soil erodibility. Colluvial and alluvial materials accumulated in fluvial terraces offer few limitations to irrigated farming other than their exposure to flood risk. Isolated Vertisols evolved from volcanic plateaux and plains, though deep, are difficult to work when wet. Channel bottom sediments, while lacking many of the characteristics attributed to suitable agricultural soils, are often farmed at the end of the rainy season while they still hold moisture.

Cape Verde's rainy season is short, commencing towards the end of August and continueing until October; rainfall during July and November is negligible. Submarginal rainfall for phaseolus beans is below 250 mm/a; for maize it is below 300 mm/a. Although rainfall increases with altitude, soil moisture available to plants is marginal to submarginal because of high, slope-induced internal drainage. Extended dry periods between rainfalls are common and are a major factor in reduced agricultural production, particularly on steeply sloping lands.

Management practices that reduce soil drainage will be important to increasing rainfed agricultural production on Cape Verde.

Upland maize yields in Santiago Island's humid and sub-humid zones are low due principally to shallow, lithic soils; stoniness; and low soil fertility. Other factors responsible for low yields may include cloud interception of radiation. Typical maize yields for altitude-related climatic zones are given below:

Table 4.1

Average Maize Yields

Agro-ecological zones	Altitude (m)	Mean annual precip, (mm)	Maize yield (kg/ha/a)
Arid	0 to 50	<150	
Semi-arid	50 to 350	150 to 300	250
Sum-humid	350 to 600	300 to 600	300
Humid	>600	>600	375

Groundwater and irrigation

Irrigation of fluvial terraces removes much of the risk associated with drought. Irrigation water derives from both surface- and ground-water sources. Wells congregate near valley mouths in the vicinity of broad fluvial terraces and where aquifer yields are comparatively high. Aquifer specific capacity rapidly declines as one leaves relatively permeable coastal basalts and encounters the older, more crystalline formations that dominate Santiago's central core. In Ribeira Seca, these more dense formations commence approximately 6.5 km upstream of the sea. From this point inland, wells rely upon water stored in valley bottom alluvium. This material derives from erosion; contains principally silaceous sands, gravels and cobbles; and is underlain by compact, impermeable basalt. This basalt is massive and, so far as is known, offers no ground-water development potential (personal communication, JRH).

Recent basalts forming Santiago Island's outer fringe are permeable. Interstitial spaces in clinkery lava at the tops of flows, cavities between lava beds, shrinkage cracks, lava tubes, gas vesicles and other openings are important in receiving, transmitting and storing water. Most of Santiago's fresh water supply derives from rainfall; a small portion may also come from condensation of dew and fog at higher altitudes. Since rainfall is low, only a limited quantity is available. This accumulates to form a fresh-water lens surrounding the central core of the

island and floating on sea water within the aquifer. This lens is in the form of an outlying ring and whose dimensions coincide to the width of recent lava flows (about 6.5 km wide at Ribeira Seca). Sea water is in contact with fresh water both at the edge of and underlying the aquifer. The thickness of the fresh-water lens diminishes from its inland extremity to the coast. Wells conceived to tap fresh water near the coast risk penetrating through the lens into underlying sea water.

The depth to sea water at any location relates to rainfall recharge and aquifer hydraulic conductivity. Tidal, atmospheric, and rainfall fluctuations, together with dispersion, create a transition zone along the fresh/salt-water interface. Excessive borewell development risks upconing saline water from this fringe (Todd, 1980). Typical well depths exploiting coastal aquifers are 15 m (personal communication, JRH). Ease of development as well as proximity to irrigable, fluvial terraces causes their location to concentrate in lowlying valleys.

Upstream wells depend on water stored in valley-bottom alluvium. These wells are invariably hand dug, have a diameter of 5 to 6 meters, are rock lined, and penetrate between 5 and 8 meters to the underlying crystalline basalt. They may have a shallow sump cut into the basalt in which to accumulate groundwater for abstraction, as well as a short, horizontal gallery underlying the stream bed. While most water is taken out by means of a bucket and hand line, small Lister pumps and windmills are also used. User visits to wells occur during evenings and mornings, the intervening time being required for well recovery. During drought (such as this year, 1991), well recovery may be sufficient to supply only 50 to 60 cms of water during 12 hours, enough water supply for about 400 people assuming a 5 m diameter well and a 45 liter water requirement.

Well ownership may be private, cooperative, or public. The distance between wells is a reflection of population density. Water consumption to fulfill human requirements receives priority over irrigation. Under current conditions when drought occupies 2 years out of 3, potentially irrigable lands may remain fallow except during the rainy season. Irrigation efficiencies are variable: conveyance losses by lined canals are slight; distribution and application losses, however, can be high. In general, most potentially irrigable lands appear to be developed for irrigation.

Soil erosion

Resource trends in Santiago Island reflect both the recurrence of extensive drought and over-exploitation of fragile lands. Although the island's landscape and climate have always been harsh, population increases have meant that increasingly

less suitable land has entered into production. The current rate of soil loss mitigates against sustainable agriculture, not only for upland farmers, but also for lowland farmers who rely on surface and groundwater for irrigation.

Soil erosion is a selective process, removing those particles and materials which are most easily transported: clays, fine silts, organic matter. These same particles are those chiefly responsible for the physical and chemical properties which contribute most to plant growth. Important also is the decrease of soil depth and of moisture holding capacity that soil erosion implies. This is particularly important in an arid climate where water stress translates into reduced agricultural and livestock yields.

Soil is more than a medium for plant growth; it also serves as a filter between rainfall and water delivered to some downstream point. Soil is a reservoir which acts to attenuate floods. It receives rainfall according to its capacity and releases this water at a rate which is both slower and more prolonged from which it was received. Eroded soil, because its profile is truncated, loses this capacity in a process which feeds upon itself in a progressively worsening way. As soil thins, runoff occurs increasingly frequently, enhancing soil erosion which, in turn, leads to more runoff in a cycle ending only when resistant bedrock becomes exposed. As Cape Verde loses its soil reservoirs, the effects of drought will be increasingly felt: irrigated land will dry up, cities will ration water, conflict related to stress and hunger may increase.

Land use terminology in Cape Verde can lead to misunderstanding. Irrigated farming, for instance, is understood to include recessional exploitation of channel bottoms as well as land irrigated by uncontrolled runoff; galleries may indicate either tunnels designed to intercept fresh groundwater or developed springs. Observation shows that the bulk of Santiago Island is under cultivation. Rainfed agriculture occupies much of the semi-arid and sub-humid land lying between 50 and 600 meters altitude; it also occupies portions of marginally suitable arid and humid lands. Soil erosion is concentrated on sloping lands, the majority of the island's surface. Present agricultural practices accelerate this process: total clearing of farm surfaces prior to the onset of rains, non-optimal plant densities, and up-and-down tillage are farming practices that favor erosion.

RESOURCE CONSERVATION

Soil and water conservation: lessons learned

Activities to conserve soil and water resources predate Cape Verde's independence. The various measures employed reflect the methods and approaches popular at the time, and include labor intensive structures and mechanical hill-slope practices such as contour rock walls and ditches. Reforestation also has a long history in Cape Verde, where trials have identified several species adapted to the country's harsh conditions. Many of Cape Verde's large sediment retention structures were originally contrived to save irrigated land from flood damage. These appear to have stabilized many channels and undoubtedly have rescued many high-value fields that would otherwise have been lost.

Nonetheless, soil erosion continues at rates which preclude sustainable agriculture. The fact that soil erosion remains a dominant risk to upland farming means that WARD will have to address the efficiency of the control methods employed in the past. By isolating their technical, social and economic limitations WARD can begin to identify methods with which to help resolve Cape Verde's worsening agricultural situation.

Soil conservation systems employed in Cape Verde include: caldeiras (lunar-shaped, rock-lined depressions conceived to concentrate and store runoff to enhance tree survival), contour ditches (called furrows), dry-masonry rock walls, check dams and gully plugs (drop-inlet spillways), sediment retention dams, groins and walls to control streamflow, wells, and ancillary works such as canals, reservoirs and tanks. Although the relative efficiency of these systems was not measured, Table 4.2 below gives an indication of the effectiveness of similar works on steeply sloping lands in other countries.

Of the measured soil losses given in the table, those from the Dominican Republic most closely resemble the geographical situation of Cape Verde: similar basalt-derived soils; steep, linear slopes; stream channels dominated by bed material load. The Dominican Republic's rainfall is higher, ranging from about 400 mm/a along the coast to 1300 mm/a at higher elevations; hurricanes cause severe runoff and erosion at about ten-year intervals; tropical storms occur every year or two. The table shows soil loss reductions ranging from 62 to 100 percent for the various treatments, and is probably representative of the erosion control efficiencies encountered in Cape Verde.

Table 4.2

Measured Soil Losses

(See Page SWC 35)

Sources: see references cited.

Hydraulic structures. Cape Verde utilizes a variety of hydraulic methods to control soil erosion, including drop spillways and cross-channel sediment retention dams. Drop spillways are installed in channels to establish permanent control elevations below which an eroding stream cannot lower the channel floor (Schwab, 1981). Under the guise of torrent control they also attenuate floods. Erosion control is a function of the dam crest elevation; torrent control relates to the slope and length of sediment retained. In either case, experience in Cape Verde and elsewhere has shown that structures of this type rapidly fill with sediment, usually within 2 or 3 years.

Evaluating these structures demonstrates some confusion between the characteristics of an actively degrading channel and those of a stable waterway. Eroding channels typically possess bare banks, undercutting is common, and eroding headwalls lower the channel floor. Stable channels, on the other hand, are variations of the topography that convey water; they likely already possess channel controls such as large boulders or underlying bedrock. The occasional construction of drop-inlet spillways in apparently stable channels is confusing.

Structures influence soil erosion by affecting sediment transport. Particle detachment, another component of the erosion process, is reduced only to the extent of a structure's backwater; after a struncture fills with sediment, its zone of influence relates to the area of its deposits. Structures do not influence soil erosion outside the vicinity of their zone of control, and may aggravate downstream channel scour if tailwater energy is not adequately dissipated. Stream power, the capacity of flow to transport sediment, relates principally to flow depth and velocity (see Einstein-Brown bedload function). A subsequent paragraph discusses the impact of these structures in reducing stream velocity; depth relates principally to runoff volume and channel characteristics. Topography, land use, soil condition, and rainfall are the principal elements affecting runoff volume. Analytical methods are available to compute the relative effectiveness of different methods of controlling erosion. Very likely, improved agriculture, animal husbandry and forestry could achieve equal or greater effectiveness at reducing erosion than do Cape Verde's many costly structures.

Structures achieve torrent control, in large part, by reducing the channel bed slope to the slope of their accumulated sediment. Torrent control occurs under certain conditions when the energy gradient of flowing water is parallel to the channel floor. Experience has shown that sediment accumulates at a slope approximately one-half to two-thirds that of the original channel. The length of upstream accumulated sediment can be computed as the intersection of two planes: that of the channel bottom and that represented by the accumulated sediment. Similarly, the general equations for turbulent flow (e.g. Chezy or Manning) can be used to compute the general impact of such structures on flood attenuation. In typical cases they offer a potential flood velocity reduction of up to about 30 percent. The amount of potential flood reduction is proportional to the fraction of channel that is treated. Experience has shown that treatments rarely exceed 30 percent of total channel length, implying the remaining 70 percent retains its normal flood velocity. They fail to be very effective in reducing flood celerity caused when the surface-water slope is not parallel to the channel bed, but reflects the frontal slope of the passing flood wave. For large floods, therefore, it can be shown that the efficiency of such structures is much reduced. Paskett (1971 and 1981) computed flood reductions of 1 to 2 percent for treated streams in Morocco. Torrent control is passing out of fashion in many countries. Because of its cost and limited effectiveness, it generally is used only for protecting expensive structures (airports, roadways) where site limitations exclude alternative methods.

Before sediment retention dams accumulate sediment, their effectiveness in storing water is identical to that of small

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reservoirs. Despite their limited sediment trap efficiency, they rapidly fill with coarse particles such as sands, gravels and cobbles. Their water storage capacity then becomes identical to that of an upwardly unconfined aquifer and can be expressed as specific yield. Because most of this material is poorly sorted, its specific yield probably varies from 16 to 20 percent. Based on the principles described above, a typical 2-meter high dam constructed in a channel having an 8 percent gradient will store a wedge of sediment 2 meters high at the dam face and which extends about 50 meters up the channel: it will retain a volume of trapped sediment equal to about 50 m3 per unit channel width. The amount of potentially available water is equal to specific yield times this volume, about 9 m3 or 9000 liters. The World Health Organization recommends a potable water supply design target of 45 liters/person/day (Jordan, 1982). Thus, a unit wedge of sediment provides sufficient water, assuming it can be totally exploited, for about 200 person days. Based on a typical channel width of 40 meters and assuming that only 30 percent of it can be economically exploited, main channel sediment retention structures could provide about 2400 person-days of water, enough for about 120 percent of an average family's annual needs. Ribeira Seca watershed is home for about 2500 households; thus, each structure supplies approximately 0.26 percent of annual person day requirements. Because suitable sites are scarce, Ribeira Seca could probably hold a maximum of 10 such structures.

Water storage increases if we take into account runoff resulting from 4 to 6 typical events per year, but decreases when we consider recharge into the underlying basalt. Recharge is controlled by hydraulic conductivity, measured by Morris and Johnson (1967) for crystalline basalt to be 0.01 m/d. Effective recharge requires high infiltration. With time, recharge rate decreases because of dispersion and swelling of clay particles and microbial clogging of soil pores. Turbid water will also clog soils. Drying kills microbial growths and vegetation growth helps break soil seals. Recharge from check dams in Israel was shown to improve water abstractions from shallow, downstream aquifers (Finkel, 1986).

The arable quality of accumulated sediment is defined by its physical and chemical characteristics. Sediment texture relates closely to reservoir trap efficiency, itself a function of available storage volume and its ratio to inflow volume (see Churchill or Brune reservoir trap efficiency curves). Given that organic material and soil fines generally pass through dams, the chemical quality of retained sediments is low. Observation of sediments retained behind structures in Cape Verde indicates that while many structures retain coarse sediments that have low soil moisture retention capacity, others accumulate fine sediments that may have some agricultural value. This variance appears to confirm general principles of reservoir trap efficiency: that large reservoirs in channels having low runoff accumulate fine

sediments that may have some agricultural value. Measurements of agricultural yield from sediments are dependent on sediment characteristics, and will not be uniform between reservoirs.

Groins, dikes and walls are employed by DGCSAFER to confine flood flows to the channel center. These appear to follow an ad hoc process rather than hydraulic design, and risk increasing bank erosion.

The functional life of hydraulic structures is related to the adequacy of their design and the effects of random floods and other events that pose risks to their survival. The DGCSAFER uses design specifications based on a 20-year structure life and a 50 percent acceptable failure risk (personal communication, DGCSAFER). Expansion of the binomial probability theorem demonstrates that these specifications require a 30-year return interval engineering design flood. Because streamflow data in Cape Verde are inadequate for design flood purposes, floods are estimated from a simple rainfall/runoff model based on the assumption that design storm and flood magnitudes are equal. DGCSAFER computations rely on point source design storm frequency-depth-durations computed for Praia (Monteiro, 1988) and S. Jorge dos Orgaos (Faures, 1987). These studies should be reviewed, updated and recomputed on a regional rather than a point source basis. Early structures used neither spillway contractions nor stilling basins; some of them collapsed due to undercutting. Current dams appear to employ hydraulic considerations in their design and older dams are being rebuilt according to improved specifications.

Stone walls. Stone walls are a sediment retention device: they affect only one element of the erosion process, transport, not soil detachment. Their effectiveness, therefore, is limited to the point of their location, not the intervening space between walls. As with inlet spillways, their effectiveness to retain sediment is related to trap efficiency. This is a function of the ratio of storage volume (itself a function of wall height and hillslope) to runoff volume and wall impermeability. Wall impermeability depends in part on the type of rock. Metamorphic is prefered over igneous and sedimentary because it can be quarried in blocks. Irregular rock such as that found on Santiago Island, because of its subangular shape, is permeable and requires backfill to totally retain runoff. With such rock, eroded colloidal particles, organic matter, and soil fines generally wash through the structure.

There is some concern that stone wall construction might aggravate soil erosion between walls. This is because stones on the soil surface often act as a protective mulch. Their removal to build walls reduces their capacity to protect soils from rainfall and insolation.

Economic effectiveness of soil and water conservation. The economic effectiveness of Cape Verde's soil erosion control program is subject to speculation. Some differentiation has to be made between erosion control and the capture of sediment by structural and mechanical works. Soil erosion is the detachment and transport of soil particles. One of its most important consequences is loss of soil fertility related to the loss of colloidal particles and organic matter, and also the loss of soil moisture holding capacity caused by decreased soil depth. Sediment retention is storage of eroded materials. In the case of small reservoirs possessing limited sediment retention efficiencies, sediments are generally medium to coarse sands and gravels. Thus, while soil erosion relates to plant productivity, sediment retention generally does not. At question here is whether or not sediment retention was necessary to create conditions in which other less costly, more efficient methods could achieve success. WARD also needs to look at other benefits such as runoff storage and control and the economic worth of water.

Table 4.3 below gives the approximate unit costs of conservation structures. It provides aggregate values of tools, labor, materials, and equipment useage, and shows that costs range from 1500$00 to 2500$00 escudos/m3. Typical drop spillways employ about 40 m3 of material; large retention structures require 100 to 140 m3.

Table 4.3

Cost of Structures (escudos/m3)

Structure type	Cost
Masonry	2000 to 2500
Dry masonry	1500 to 2000
Gabion	1800 to 2300

Source: Personal communication, DGCSAFER

A preceding paragraph computed the volume of water stored by a typical sediment retention dam. Using a construction cost of 2300 escudos/m3 of gabion masonry and assuming 140 m3 of gabions required to create a structure 40 meters wide, total structure costs is 322,000 escudos or $4181.82. Total available water storage, based on 9 m3/unit width, is 360 m3. Adjusted for abstraction efficiency, this reduces to a unit cost of water of $348.48/m3; prorated over a 20 year structural design life, this becomes $17.42/m3. This compares to an unsubsidized cost of water in Praia equal to $3.00/m3.

Chapter III gives an economic analysis of watershed

development methods proposed for WARD. We need to bear in mind that although depreciated cash-flow analyses give the comparative worth of different alternatives, other considerations are also important. In Cape Verde the physical scarcity of irrigable and high quality rainfed agricultural land is important to national survival. Also, upland maize and bean production has tremendous cultural importance to Cape Verdians.

The economic impact of soil conservation technologies has not been computed for Cape Verde. Table 4.4 gives the framework for analyzing the impacts of soil conservation on a with and without basis.

Table 4.4

Economic Analysis of Soil Conservation Technologies

Costs	Impact	
	of erosion	of conservation
Seed Fertilizer Manure Labor Fertilizing Cultivation Harvest	Decrease in proportion to productivity loss. " "	Decrease in proportion to land taken out of production. Increase in proportion to productivity increase. " and decrease in proportion to land taken out of production.
Revenues Harvest		

Source: Magrath, W. 1989.

Socio-economic effectiveness. The socio-economic perception of soil conservation in Cape Verde appears to be low. The practice of relying on massive structural undertakings causes rock masonry to be confused with soil conservation. The scale of the methods employed gives farmers the impression that soil conservation exceeds their available means. During the preparation of this paper we observed few if any farmers actually employing structural soil conservation methods on their own land. Farmers do appreciate trees, however. An additional 10 percent seedling production is generated by each project nursery for free distribution. Table 4.5 summarizes the key elements of a people-

oriented approach to soil conservation. Its underlying principle is to enhance soil conservation so that it is implemented on the basis of perceived benefits, not as a work activity whose objectives appear unrelated to upland farming.

Table 4.5

Approaches to Land Husbandry

Old or conventional approach	New approach
Soil conservation defined as prevention or reduction of soil erosion or volume of soil lost.	**Soil conservation** defined as the design and application of land-use systems that preserve or enhance soil fertility and are at the same time attractive to the user.
Clearly identifiable signs of erosion on the land: a) changes in surface soil texture, b) rills and signs of soil wash, c) dark topsoil washes off, lighter, less fertile subsoil exposed, d) formation of gullies and badlands.	**The emphasis changes in three ways:** a) from soil loss to soil fertility (we are interested in soil productivity, not tons of soil lost; b) from conservation techniques to land use systems (the environment is degraded because it is being wrongly used); c) from the land being first to the farmer being first (higher income, higher social status, lower energy requirements, etc.
Identification of applicable conservation techniques, with the emphasis on agricultural engineering structures such as systems of graded banks or terraces and down-slope drains with drop structures or check-dams: a) design of layout (farm planning), b) design of spacity and capacity.	**The project design is therefore:** a) data collection and survey (physical, social, economic); b) identification of alternative land use, modification of existing use, or design of new use (for each land unit); c) discussion with community farmers; and d) implementation in partnership with the community.

(Continued next page)

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Table 4.5 (cont)

Old or conventional approach	New approach
Implementation is by paid work party, by subsidized farmers, or by government. Soil conservation is understood to mean employment.	**Implementation** is by individual farmers and or groups who undertake soil and water conservation because of its benefits to crop production.

Developed from: World Food Program. 1987. AGLS forum for discussion. Unpublished. Rome.

Resource sustainability. Finally, one must address the issue of the impact of soil conservation to resource sustainability. Soil is conserved if its rate of formation equals or exceeds its rate of loss. The relationship between soil formation and loss is expressed as soil loss tolerances, the backstop value beyond which soil loss exceeds formation. Table 4.6 gives soil loss tolerances according to plant requirements and relative soil formation rate. Lal (1988) also provides an equation for computing soil loss rate.

Table 4.6

Soil Loss Tolerances (t/ha/a)

Soil rooting depth (cm)	Soil loss tolerance	
	Renewable soil	Non-renewable soil
0 - 25	2.2	2.2
25 - 50	4.5	2.2
50 - 100	6.7	4.5
100 - 150	9.0	6 7
150+	11.2	11.2

Source: McCormack, 1981.

Comparison of the above table with Table 4.2 shows, despite the application of soil conservation technology, that soil erosion on steep slopes often exceeds soil loss tolerances by

between 1 and 2 orders of magnitude (important exceptions to this generalization are land use systems that employ perennial vegetation or ground cover, e.g. woodland in Burundi, no-till systems in the Dominican Republic, and Rhodes grass in Tanzania). This disparity between recommended tolerance levels and actual erosion rates signals that soil losses, though unmeasured, probably mitigate against sustainable upland agriculture despite Cape Verde's soil conservation program. Observation confirms this rate of soil loss: areas in which soil loss exceeds 80t/ha/a generally have rill formation associated with bare, eroded channels. As was mentioned previously, the loss of Cape Verde's upland soils will create an untenable situation for the island's agriculture, irrigated as well as upland; it will also reduce water supply reliability.

The effectiveness of rock walls, contour ditches and similar contour-related devices to conserve water and soil is a function of storage capacity which itself depends on land slope. Table 4.7 below gives the relative effectiveness of contouring, and shows that it becomes ineffective on slopes beyond 25 percent.

Table 4.7

Slope-related Effectiveness of Contouring

Land slope (percent)	Effectiveness (percent)
1 to 2	40
3 to 5	50
6 to 8	50
9 to 12	40
13 to 16	30
17 to 20	20
21 to 25	10

Developed from: Table 13, Wischmeier, W. 1978.

Water supply and conservation. Analysis of watersheds neighboring Ribeira Seca shows that springs may number several hundred and supply about a third of water used; hand dug wells number about 50 and supply less than half the valley's water; boreholes number 13 and provide about one-fourth. Water conservation is so intrinsically dependent on soil conservation that many of the methods used to reduce soil loss act to improve water supply and reliability. Despite water's scarcity, its use for irrigation appears to be poorly managed.

Most pumped wells are publically owned and managed by the JRH. A principal constraint to groundwater use for irrigation is the thinness of the aquifer in the vicinity of lowland irrigated

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fields and the concomitant risk of upconing underlying saline water. This requires that well fields be carefully managed, that pumping rates remain low, and that pump operation be coordinated between pumps.

These same constraints do not apply to wells further inland that rely solely on water stored within channel-bottom alluvial deposits. These deposits overly crystalline basalt that offer little or no ground-water development potential. Permeable basalt extends from the basin mouth to about 6.5 km inland from the sea.

The alluvial aquifer in Ribeira Seca is currently exploited to near the maximum of its potential. Additional land and well development for irrigation is dependent on rainfall recharge: irrigation during drought years would introduce competition and possible conflict between agricultural and domestic users. Irrigable land during drought is in fallow except during the rainy season; during non-drought years it is irrigated and cropped throughout the year or until the aquifer reaches danger levels.

Adaptive research

Adaptive research is important to soil and water conservation in order to identify appropriate plant materials and methodologies, and to measure the effectiveness of soil and water conservation activities. It helps avoid errors associated with introducing untested technologies to farmers unable to afford high levels of risk. It also provides important information to decision makers who need to know the relative worth of different courses of action.

The preceding Watershed Development Project did not measure the effectiveness of the soil and water conservation technologies it employed. Runoff parcels were installed at Fontes and also Picos, but details of their results are inconclusive. During the course of preparing this project paper we visited several Parshall flume installations in paired watershed studies (see Norton, 1987 and Mannaerts, 1985, 1986a and 1986b). The selection of a Parshall flume for hydraulically supercritical, high sediment load channels is incorrect, and conclusions derived from their measurements will be misleading.

The use of any structure to measure discharge is based on the concept of the structure controlling the flow in the channel approaching it. If the approach channel is so steep that flow at normal depth is supercritical, gaging is impractical unless the design of the structure is such that it backs up the flow sufficiently to provide a zone of subcritical flow just upstream. Its approach channel is then effectively a stilling basin (Ackers

et al, 1978). In the sites visited, this is impractical because sediment load would soon occupy the effective portion of the upstream stilling basin. The floor of a Parshall flume is horizontal in the converging section, slopes downwards in the throat, and is inclined upwards in the expansion. The control section, at which the depth is critical, occurs near to the downstream end of the convergence, upstream from the throat. When the downsloping portion of the flume fills with rock, the effective control portion of the flume moves upstream, creating a positive error in its reading. However, because the site is supercritical, water will likely hurdle through the flume independent of its hydraulic design characteristics. Alternatives to a Parshall flume will depend on the sites estimated Froude number, and are described in standard texts on hydrometry.

Research needs by WARD include a rapid, comprehensive review of the effectiveness of soil and water conservation employed by the previous watershed development project. WARD needs to measure the structural soundness of dams and other structures erected, and also evaluate soil evolution behind these devices. In order to enhance their design, WARD needs improved methods of estimating design flood peaks and channel hydraulic characteristics. This requires regional analyses of design storm rainfall-depth-duration. Most critically, WARD needs to know the effectiveness of the soil and water conservations methods it will recommend. A subsequent section of this analysis describes these activities and their requirements.

Training

Training in soil and water conservation by the previous projects concentrated on building the institutional capacity of INIA and DGCSAFER. Within DGCSAFER there are now five individuals with university training; within INIA the number is higher. Because of departures, the number of individuals who successfully completed university training exceeds the number now employed by government. Given their combined skills, these organizations have the required talent to undertake moderately complex technical design and project monitoring activities. They could be overtaxed by projects in many separate locations, however.

Little on-the-job training in soil and water conservation appears to have occurred during the life of the previous project: watershed management plans and soil surveys are authored by contractor personnel; rainfall analyses are by Agrhymet and other foreign collaborators. Analyses related to erosion and sediment control borrow heavily from published works, are complex, and give no indication of Cape Verdean participation. Similarly, little training other than in gabion construction

appears to have been given to participating populations.

WARD SOIL AND WATER CONSERVATION ACTIVITIES

Objectives and strategy

WARD seeks to improve resource management on Cape Verde by linking applied research to ongoing work in soil and water conservation. By using knowledge gained from its experience in the preceding Food Crops Research Project and Watershed Development Project, it hopes to improve the efficiency of activities and methods that conserve and sustain soil and water resources while increasing their productivity.

Table 4.8 gives the scale of soil conservation work completed on Santiago Island up to 1988. The foregoing discussion shows that while structures, walls and ditches reduce soil erosion, they fail to do so in a way that leads to resource sustainability. The following text describes alternative methods that achieve soil conservation and at the same time enhance agricultural productivity. Very likely, WARD will require a compromise, one that recognizes the country's historical context of structural soil conservation and the need for employment, but also the need to conserve soil and water. Eventually, WARD should look to phasing out workfronts and increasing farmer-implemented soil and water conservation.

Table 4.8

Soil conservation implemented on Santiago Island

Conservation method	Area protected (percent)
Unprotected land	66
Terraced	8
Stone walls	12
Drop inlet structures	6
Afforestation	27
Land with at least one of the foregoing treatments	34

Source: Ministerio do Desenvolvimento Rural e Pescas, 1990.

Although WARD will initially support workfront activities in

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soil and water conservation, this will gradually decrease so that, by year five, workfronts will concentrate only on afforestation (Appendix 4.2.2), maintenance of channel-bottom structures, and maintenance and construction of irrigation conveyance systems, wells and galleries. At the same time, individual farmers or farmer groups will gradually replace workfront activities on sloping uplands. This will rely heavily on extension, and initially concentrate on farmers who own and till their own land or have secure access to land (see social soundness analysis, Annex 4.3). Such farmers are usually better able than individuals with insecure land tenure to accept the risks associated with improved farming methods.

Assuming that the soil conservation statistics computed for Santiago Island (Table 4.8) are representative of individual watersheds, Table 4.9 gives an estimated breakdown of treated areas in Ribeira Seca (total land area = 7400 ha). Although it shows that nearly 5000 ha are without soil conservation treatment, only a fraction of this land is suitable for cropland; the remainder is better occupied by forest and rangeland.

Table 4.9

Estimated Soil Conservation Areas in R. Seca

Conservation method	Area protected (hectares)
Unprotected	4884
Terraced	592
Stone walls	888
Drop inlet structures	444
Afforestation	1998

The following text outlines WARD's on- and off-farm soil and water conservation activities including ground-water development and conveyance systems. Subsequent sections examine technical adaptive research, monitoring and evaluation; training and technology transfer; environmental impact and risks; technical assistance; outputs and activity costs. Although the implementation of upland soil and water conservation will concentrate on Ribeira Seca, maintenance of existing structures will occur throughout Santiago Island.

Soil and Water Conservation Activities

Land use planning and integrated design. Land use planning seeks to optimize land use in ways that match crop requirements to site characteristics, constraints and risks. Its objective is

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to balance user requirements with land productive capacity, but to do it in ways that are sustainable. Examples of plant requirements include rainfall availability and reliability, radiation and temperature. Edaphic constraints important to crop selection and culture include soil moisture availability, soil physical and chemical characteristics, and rooting conditions. WARD also needs to consider soil erosion by estimating its magnitude under different management schemes. Land use planning provides the essential tool to separate land according to its optimal use -- forestry, range, cropping -- and identify production patterns that offer sustained returns. Examples of land husbandry methods that increase yields and promote soil conservation include planting to optimal densities using quality seed, implementing hedgerow farming methods or stripcropping, conserving soil moisture with mulch, and improving soil organic matter with plant residues.

Integrated design has the objective of making sure the component systems of a watershed come together in a cohesive, harmonious, sociologically sound way. It seeks to avoid developing one resource at the expense of another, or favoring one farmer group while ignoring another. An example of design that is not integrated is irrigation development in which lowland farmer groups receive benefits, but rainfed farmers do not.

WARD, as one of its first activities, will perform a rapid reconnaissance-level survey of Ribeira Seca watershed. Its objective is to gather the essential information necessary to understand existing land use patterns, identify physical and socio-economic constraints to land and water use, and collect data -- aerial photographs, rainfall and soil information, land tenure data, etc -- essential to planning and design. While this will be a Cape Verdean activity, it will receive short-term technical assistance in watershed planning and socio-economic investigations from WARD. Its dominant method will be reconnaissance-level landscape, agronomic, range, forestry, and sociological surveys. INIA in collaboration with DGCSAFER, USAID and its contractors will author and publish the survey's final report; its due date is 3.5 months after project inception.

Baseline data analyses. The preceding section describes rapid reconnaissance-level collection of information necessary to the operational planning of WARD's soil and water conservation activities: deciding the type, location and timing of specific undertakings. Before this can occur, these data require analyses. Complex soils information needs expression in ways that can be understood by laymen and be related to plant productive capacity. Design of hydraulic structures requires regional frequency-depth-duration analysis of design storm rainfall (see Watkins and Fiddes, 1984). WARD will provide short-term technical assistance in performing these analyses for Ribeira Seca watershed; thereafter DGSCFER and INIA will

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undertake similar analyses for the remaining watersheds on Santiago Island. Some of these analyses can best serve project needs if published in the form of technical monographs, along with a description of how to use the information. An example is a monograph on how to compute engineering design floods using analyzed rainfall and soils data. These monographs should include all maps, charts, graphs and tables required to complete design activities at a point location anywhere within Ribeira Seca watershed. DGCSAFER in collaboration with INIA, USAID and its contractors will publish the monographs; their due date is month 6.5 after project inception.

Operational planning. The preceding sections describe baseline data collection and analyses essential to understanding Ribeira Seca's natural and human resource situation. Operational planning is the formulation of a logical sequence of activities -- what, when and where -- developed from this information. It is a management process designed to optimize resource use: time, money, human, land, plant and animal. The operational plan is a collaborative process not only among different agencies, but also across different disciplines within those agencies. Some activities such as large engineering structures will be unable to proceed before the necessary engineering design data are collected, analyzed, and published in useable form; other activities such as agricultural extension and tree planting -- those activities that pose little risk to life or infrastructure -- can proceed on the basis of knowledge gained from previous activities in Ribeira Seca. As with other documents, government agencies in collaboration with USAID and its contractors will author WARD's operational plan. Its due date is month 8 after project inception.

On-farm soil and water conservation activities. On-farm soil conservation activities are founded on the principle that appropriate agronomic and animal science technologies conserve soil and water as well as increase farm revenues. Major constraints to farm production in Cape Verde are inadequate soil moisture reserves and low inherent soil fertility. Inadequate soil moisture reserves relate principally to internal drainage, itself related to soil hydraulic conductivity, hydraulic gradient, and soil depth; organic matter relates to biomass productivity and oxidation and erosion losses. Young (1987) estimates 2.1 t/ha/a above-ground plant residues and 1.4 t/ha/a root residues are required to maintain topsoil carbon levels of 0.5 percent in a semi-arid environment. His evaluation of the carbon balance assumes erosion losses are 10 t/ha/a; under Cape Verdean conditions in which soil losses exceed 80 t/ha/a, eight-fold productivity increases would be required simply to maintain soil carbon. This level of increase is virtually impossible given Cape Verde's climate and geography. Project activities can reduce soil erosion and concomitant soil carbon losses, however.

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On-farm soil and water conservation activities can enhance soil moisture reserves by using contour tillage. Contour tillage has two major effects: 1) contour furrows intercept runoff, thereby enhancing infiltration by increasing depression storage, and 2) contour furrows intercept subsurface interflow conduits, retarding internal soil drainage -- subsurface soil moisture is retained in the root zone where it is available to plants. On-farm soil conservation practices also seek to protect soil surfaces from the impact of rainfall. Plant residues play an important part in preserving the soil surface prior to the onset of seasonal rains; crop foliage also helps protect soil surfaces during the cropping season.

One way of assuring production of adequate quantities of crop residues for soil and water conservation is through land-use planning. Land unsuitable for annual crop production might better be used by perennial plants such as pigeon pea. Alternatively, strip-cropping or hedgerow agroforestry offers opportunities to reduce soil losses through mixed cropping and biomass production. Strip-cropping and hedgerow agroforestry should be on the contour, already identified over much of the basin by contour rock walls. The quantity of biomass required to reach a target level of soil loss can be estimated using an appropriate soil loss model, e.g. SCUAF from ICRAF in Nairobi. Biomass quantity can be adjusted by hedgerow spacing, stripcrop width, and hedgerow width.

Soil loss monitoring and modelling are key techniques in identifying the land management alternat ves available to WARD. Obviously, some combinations of slope, soil and rainfall are unsuitable for upland cropping. Sylvo-pastoralism and forestry offer sustainable uses for such lands.

WARD's methods rely on para-extensionists to train farmers in their use. The project will fund its technology transfer and on-farm research needs under the outreach organization created by the WDP -- the Rural Assistance Program or RAP in conjunction with the national extension service, DGER (see Social Soundness Analysis). WARD will actively collaborate with IFAD by supplying materials, tools, supplies, training and other items where required. WARD will also monitor progress in soil conservation and soil development (see section below).

Extension is a phased activity during which, early in the project, WARD informs farmers about its objectives and scope -- it seeks to actively involve farmers in project planning. At this stage of project development, WARD's agricultural message relies on simple but pertinent technology -- contour tillage, seeding to optimal densities, contour cropping systems using popular plants such as Cajanus. Extension seeks to identify lead farmers who can act as contacts and, by producing demonstrable improvements in production, help promulgate WARD's methodology.

WARD will not focus on soil and water conservation, but introduce it through the back door of improved soil productivity.

In its reliance on extension, WARD needs to carefully utilize its scarce human resources in order to effectively reach all of Ribeira Seca's project participants. This requires a more vertical extension structure than currently exists within DGER, but one which can be easily achieved by integrating complementary levels developed from within RAP and, subsidiary to these, carefully selected contact farmers. Productivity increases, to serve as effective extension reference points, should be sufficiently large as to be visual to casual observers.

Eventually, research data will help WARD to fine tune its extension message. Research plays a key role in on-farm soil and water conservation by identifying the biomass production necessary to achieve target soil loss rates. Soil and water conservation methodology is not uniform throughout the targeted watershed, but varies according to farmer aspirations, crop patterns, and site conditions. Research will help identify the adjustments and inputs necessary to improve crop production within target soil loss constraints.

Off-farm soil and water conservation. Like on-farm soil and water conservation, off-farm activities relies on land use planning and integrated design to assign priorities on the basis of productive capacities and farmer needs. An important off-farm soil conservation practice is forestry and improved pasture or range, especially on land that is unsuitable for cropping. Land suitability for different uses relates principally to soil moisture availability, itself related to climate, and to edaphic constraints, particularly those related to soil erosion. Table 4.2 gives the relative effectiveness of forestry and grassland in reducing soil losses.

Structural and mechanical conservation methods -- rock walls, contour ditches, drop-inlet spillways, dikes and walls, and gully plugs -- have a history of application in Cape Verde that predates independence. They are particularly valued because of the workfront labor they provide and, in some cases, their effectiveness in diverting irrigation water and controlling channels. As described in preceding text, the effectiveness of many of these methods is questionable. In terms of the historical evolution of soil conservation in Cape Verde, however, it is probably prudent for WARD to continue with some of these methods for the time being, but on a diminishing basis. WARD also needs to view their maintenance and eventual replacement. The chain effect of an upstream check-dam failure is speculative on structures of this scale. Experience in Algeria, Morocco and Haiti demonstrates that the failure of one structure generally causes other structures to fail in series (Paskett, 1971 and

1981). During 1984, the failure of a single large, upstream structure in Cape Verde caused the sequential failure of 12 similar, downstream structures.

Insofar as structural methods on sloping lands are concerned, WARD should view their near total discontinuation within 5 years. Outside of mainstream channels and unless functionally related to irrigation canals, other infrastructure, or storing soil that demonstrates sufficient pedological evolution to maintain emergent, agriculturally important vegetation, gully plugs and torrent control structures should be discontinued and allowed to fail without replacement. Individual farmers should assume responsibility for building stone walls on their own land.

In its off-farm soil and water conservation program, WARD will concentrate its resources on mainstream structures and conveyances related to irrigation, and the repair and upgrading of large cross-channel drop-inlet structures such as sediment retention dams. Structural repair and upgrading will target structures having obvious design inadequacies: lack of contracted spillways, lack of settling basins, lack of wire protection on stepped gabions, etc. Where appropriate, it will also undertake the construction of similar structures given that an integrated plan and structural design is first drawn up to adequately describes their technical worth and impact (volume of water and sediment retained, impact on channel hydraulics, impact under failure, etc.). WARD will support upgrading and repair of structures throughout Santiago Island.

Given the history of structural soil and water conservation in Cape Verde, WARD will undertake limited construction of cross-channel structures in non-principal channels. This construction will gradually decrease by about 20 percent/a, so that by the end of year 5 essentially no such additional structures will be built. Exceptions to this rule after year 5 will be on the basis of demonstrated need and impact, e.g. to protect or provide an irrigation canal or roadway. As before, engineering design will dictate any construction.

In order to reduce material expenses, WARD will encourage local gabion manufacture. A CARITAS Foundation cooperative in Camp Perrin, Haiti weaves gabions on a production basis; in Burkina Faso a similar cooperative is also active. WARD's support could include help in forming a cooperative, funding a visit to CARITAS in Haiti or bringing someone from CARITAS to Cape Verde, building simple weaving frames, constructing a roofed area to shelter weavers, providing management training, and importing an initial supply of gabion wire. This is an enterprise development undertaking that should be independent of support within 4 years.

For the purposes of this project paper, we assume WARD will construct 30 drop inlet and 5 main channel structures in Ribeira Seca. In the remainder of Santiago Island WARD will also construct an additional 300 drop inlet and 20 main channel structures. These quantities derive from a rudimentary survey of Ribeira Seca and other watersheds during the course of project paper design. The exact number of works to be constructed depends on watershed planning and engineering design to be conducted during the LOP. Assuming the work normes listed in Table 4.10, these will utilize a total of 2501 person months of labor. Construction is a phased activity decreasing 20 percent each year, so that by the end of year 5, work on this type of hydraulic structure is virtually zero.

Table 4.10

Work Normes

Activity	Labor requirement (m3/d)
Excavation	1.00
Masonry	0.15
Dry rock masonry	0.35
Gabion masonry	0.45
Rock transport	0.50

Source: Personal communication, USAID

Groundwater and irrigation development. At the time of this project paper preparation we do not know the amount of potentially irrigable land that remains undeveloped in Ribeira Seca watershed. We assume that spring developments, terracing, diversions, and canals will permit irrigation of some of the gently sloping land bordering the mainstream channel. The amount of this land will become known following completion of land use planning and baseline data analyser. Only after that time can WARD develop the necessary designs and plans for its development.

Increasing dry season water supplies depends on developing runoff storage or tapping into groundwater. Reservoir surface storage, in the majority if not totality of cases, is impractical due to high sediment accumulation rates and extensive grouting requirements. In comparison to surface water, however, groundwater offers development opportunity. The majority of upstream water supply appears to come from developed springs and hand-dug wells; pumped wells are important in the lower watershed reaches. Pumped well development, however, is limited by its potential to introduce saline water to other nearby wells. Upconing of underlying saline water could have a serious, detrimental impact on irrigated crop yields.

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As has been explained elsewhere in this document, irrigable land is already developed to near its full potential in Ribeira Seca. Additional land brought into irrigated production, because of water supply constraints, would only be irrigated during non-drought years, currently 1 year out of 2 or 3. The amount of water available in the upper watershed can be computed as the specific yield of alluvium stored in the mainstream channel. While occasionally plentiful, use of this water during drought would conflict with domestic users. The underlying, crystalline basalt has no groundwater development potential (personal communication, JRH).

Potentially irrigable land fulfills a complex set of selection criteria. Its slope and soil depth have to be such that terracing or land levelling won't reduce its inherent productivity by exposing subsoil or bedrock. It requires an upstream water source that can be developed sufficiently to meet plant and other requirements. Finally, water source and irrigable land have to be connected by canals that are economically feasible to build and socially feasible to operate and maintain. FAO Irrigation and Drainage Paper No. 24 (1977) outlines the general design considerations of small-scale irrigation projects.

For the purposes of this project paper, we estimate WARD can develop up to 9 additional hectares of potentially irrigable land in Ribeira Seca. We assume that planning and design activities will occupy WARD's first 2 years, and that actual construction will not commence until year 3. We further estimate that 9 hectares of additional irrigated land will require up to 3 diversions and up to 10 km of lined canals. Total construction labor based on terracing and retaining wall construction will be about 3975 person months assuming current work normes apply.

Adaptive research, technical monitoring and evaluation

Adaptive research, technical monitoring and evaluation serves to answer 3 key questions: 1) Are WARD's activities conserving soil? 2) Is the amount of soil lost within limits defined by soil loss tolerances (are WARD's activities causing soil losses that exceed rates of soil formation)? and 3) Are WARD's activities conserving water? This contrasts with project monitoring, the measuring of quantities of work accomplished, inputs and time; and financial monitoring, the accounting of cash flow; and socioeconomic monitoring of PLI.

Soil loss monitoring will use runoff plots similar to those used to measure the soil loss data reported in Table 4.2 and described by Mutchler, Murphree and McGregor (1988). The objective of these plots is to measure the comparative effectiveness of WARD's activities in reducing soil loss and

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runoff; not calibrate Universal Soil Loss Equation (USLE) coefficients of soil erodibility, rainfall and runoff factors. Because of this, instrumentation and data collection requirements are considerably reduced from that used in research station activities totally dedicated to this type of analysis.

In conducting these measurements WARD wants to confirm the effectiveness of hillslope treatments to conserve soil. USLE runoff plots specify a 9 percent slope and a length of 72.6 m. WARD requirements are less demanding but should be representative of upland areas in Ribeira Seca: runoff parcels should be sufficiently wide to eliminate border effects; they should also be long enough to develop downslope rills; runoff storage capacity should equal that computed for a 100-year, 48-hour design storm. Individual parcels will receive different treatments -- stone walls, hedgerow agroforestry using different hedgerow densities, traditional agriculture, agroforestry stripcropping, contour tillage, etc. -- and be compared to runoff and soil loss from a parcel in bare fallow. Runoff plots should operate for a minimum of two years before any conclusions are drawn from their data.

In evaluating the technical effectiveness of its undertakings, WARD will transpose the knowledge gained from its runoff parcels to Ribeira Seca watershed on the basis of area treated according to different conservation methods. Area treated will be computed on the basis of field size of participating farmers. In order to refine its monitoring, WARD will also compare the relative quality of farmer work with that of treatment implemented on the research parcels. Stocking (1988) discusses several methods for assessing vegetative cover and management effects. This monitoring will gage the effectiveness of soil conservation implemented on fields, not entire watersheds.

During previous activities INIA installed several paired basin studies. Paired watersheds normally go through a calibration period lasting at least 10 years. One watershed is then treated and the effects of this treatment are compared to its paired control, usually for several years. Other alternatives exist: correlating a single watershed to rainfall or correlating to a process-oriented model. Unit source watersheds of this type imply that only a single crop is grown and that treatment is received on an entire watershed. Because of the time, expense and expertise required by this type of undertaking, WARD will not conduct unit source watershed studies.

At some time in the future WARD may decide it needs to know the amount of soil lost by the entire Ribeira Seca watershed. Because of measurement complications, this activity should use one of the standard process-oriented soil erosion and sediment flux models. Because these models require considerable

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experience, the exercise should be contracted rather than attempted by INIA or DGCSAFER. Although expensive, modelling will cost considerably less than establishing a hydrologic network in unstable channels having infrequent, hydraulically complex flow.

Part of WARD's mandate is to implement practices that conserve water. Part of this will occur on rainfed land where contour tillage and other methods reduce torrential runoff and increase water availability to crops. WARD will measure water conservation using the runoff parcels described above. Also important to water conservation is irrigation use. Irrigation water use can be improved if water supply is matched to plant and soil requirements. Plant irrigation water requirements vary according to the stage of plant development and the amount of water received from rainfall or other sources. Generally, planned water use for irrigation is often considerably less than irrigation delivered on the basis of tradition or force of habit.

In order to improve water use, WARD will develop an irrigation computer model designed to match plant and soil requirements (see FAO irrigation and drainage papers 24 and 33). It will rent selected irrigated pracels within Ribeira Seca both to test its model, compare water use to traditionally irrigated parcels, and demonstrate water conservation to irrigators. INIA will be responsible for model development and comparative studies; it will collaborate with RAP and DGER in demonstrating water conservation use to participating farmers. Model development will rely on agroclimatic data stations already operative on Santiago Island.

Training and technology transfer

Training and technology transfer are essential activities in raising the capacity of WARD participants to manage Cape Verde's soil and water resources. WARD is designed to train all levels of participants, individual farmers as well as researchers, in skills which best serve to increase resource productivity and sustainability. Table 4.11 gives WARD's soil and water conservation training schedule, describes training requirements, and provides a typical course structure.

Table 4.11

Soil and Water Conservation Training Schedule

Title	Typical participant	Training requirements	Typical sourse structure: a) duration b) place
Advanced technical training	Head of INIA, DGCSAFER, DGER, etc.	Experience sharing, learning new ideas	a. Up to 1 month b. International research institute or conference
Expert workshop	Researcher, senior engineer, senior extensionist.	Detailed exchange of ideas and information. Publication of proceedings.	a. 1 or 2 weeks b. Anywhere
Graduate study for practitioners	Senior engineer or extensionist	Graduate training in theory and practice of soil and water conservation, other pertinent subjects.	a. MSc 2.5 yrs b. Out-of-country university, thesis work in-country.
Diploma study for recruits and practitioners	Proven practitioner or promising recruit	Under-graduate training in pertinent subjects: agronomy, forestry, soils, civil entineering, etc.	a. BSc 4.5 yrs b. Out-of-country university.
In-country technical training	Proven practitioner: agronomy, soils, forestry, range, etc.	Practical training at design level, either by visiting trainers or local staff.	a. Series of 1 month courses b. In-country training center

(Continued next page)

Table 4.11 (cont)

Soil and Water Conservation Traing Schedule

Title	Typical participant	Training requirements	a) duration b) place
Operational level training	Field assistant, conservation assistant, extensionist	Practical training at construction level by local staff	a. Series of 1 month courses b. In-country training center

DGCSAFER has expressed a need for one engineer trained to MSc level in dam design and foundations. It also needs 1 additional BSc-level engineer and 4 technician-level individuals. Both DGCSAFER and INIA need training in non-structural soil conservation methods, monitoring, and management. Short term and recurrent technical assistance (TA) will address these subjects during the project.

Technology transfer is critical to the success of WARD activities in upland agricultural areas. Technology transfer concentrates on teaching participating farmers the essential skills they require to improve management of their soil and water resources. The topics to be extended are strongly linked both to lessons learned from the preceding watershed development and research projects, and to research sponsored by WARD. The project will fund its technology transfer under RAP in conjunction with DGER.

Technical assistance

Technical assistance in soil and water conservation activities will occur at different intervals throughout the life of the project and be short term and recurring short term . Long term TA is related more to project management than soil and water conservation activities, and is described elsewhere in this document. Individual TA assignments will last between 4 and 6 weeks. Early during the life of the project TA will assist INIA and DGCSAFER in conducting rapid reconnaissance surveys of Ribeira Seco, analyzing the data these surveys provide, and developing operational project plans from them. A TA hydrometeorologist will also assist INIA in conducting regional frequency-depth-duration design storm analysis of recorded rainfall data, and authoring a brief engineering drainage design manual providing methodology on how to use the resulting design

curves. A TA irrigation engineer will also help DGCSAFER to establish structural irrigation design specifications. These and other TA visits are outlined in Table 4.12 below.

Table 4.12

Technical assistance

Discipline	Duration*	Objective
Land use planner	ST	Assist INIA and DGSCFER perform rapid reconnaissance of Ribeira Seco, analyze and publish results.
Hydrometeorologist	ST	Assist INIA perform regional frequency-depth-duration analysis of design storm rainfall and publish results.
Civil/agricultural engineer	ST	Assist DGCSAFER to produc design specifications for structural works and irrigation systems.
Soil erosion specialist	RST	Assist INIA to establish runoff plots, collect and analyze data, and publish results.
Management systems	ST	Assist INIA and DGCSAFER develop efficient management systems that reduce overhead.
Unspecified	ST	To be defined

* ST = short term, RST = recurrent short term

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Sustainability and feasibility of WARD

Research throughout much of the world has demonstrated the effectiveness of agronomic methods in controlling soil loss. Structural methods have a role in reducing aggravated, concentrated soil erosion or runoff to levels in which biological methods can be effective. This role is complementary to proper land use; it is ineffective when applied in isolation or exclusive of the kinds of management that a land use ethic implies. WARD seeks to address this gap by inculcating soil and water conservation in the guise of a program that improves soil productivity, thereby gaining a means of acceptance within participating farmers. Its technical feasibility and sustainability is affirmative within the scope of its capacity. Land that is inherently unsuitable for agriculture, when denuded and cropped, will continue to degrade. Thus, while WARD is technically feasible and sustainable, final judgement rests with its social acceptability. If adopted by Cape Verde's population, WARD will succeed. If WARD fails, however, serious thought needs to be given to the reasonableness of continueing investment to this sector. Other more serious problems, of which soil erosion may only be a manifestation or symptom, may be at cause.

Environmental impacts and risks

Structures. Among other things, WARD's objectives are to conserve soil and water. While both these subjects are environmentally benign, there is considerable environmental risk posed by large, main-channel structures. While this risk can be minimal if engineering design procedures are adhered to, WARD needs to bear in mind that not all of the existing structures did this. WARD also need to take into account that these structures are constructed in series, and that there could be a chain effect in which the failure of one could effect the failure of the others. The risk of dam breach varies according to age of the structure, its design, and the occurence and magnitude of random floods. Although a cross-channel structure rapidly fills with sediment, it initially operates as a reservoir. Assuming a reservoir filled with water fails, the effect of a breach would vary according to whether it was sudden or slow, and to the amount of water contained in the reservoir. The worst-case scenario is of a sudden breach of a filled reservoir. This water would cascade down the channel, probably overtaxing any downstream dams and adding their volume of water and sediment to the flood wave. This would likely damage or destroy any downstream irrigation conveyances and roadways. The likelihood of such a failure is expressed by DGCSAFER's structural design specifications, notably 20-year design life with 50 percent acceptable failure risk.

Assuming a dam filled with sediment fails, the breach would likely be slow. If only the central or wing portion of the structure failed, probably only the mid-channel or side portion of its sediment would join the flood wave. Passage of the sediment would depend on its nature, the volume of water available in the flood, the slope of the channel and other characteristics. The worst-case scenario would involve a non-Newtonian mix of water and sediment similar to a debris flow cascading down the mainstream channel. As with water this would engulf or damage downstream structures, probably causing their failure. It would likely deposit large volumes of sediment over irrigated fluvial terraces, forcing their abandonment.

The worst of all possible cases is a mix of these two events, high volumes of water associated with high volumes of sediment involving a sudden series of breaches as the flood wave advanced downstream. It would probably require the sudden failure of a reservoir occurring conjointly with overturning of a sediment retention dam. Such an event would probably mean the end of irrigated agriculture wherever it occurred.

Improved engineering design will lower this risk but not prevent it. WARD promises to rehabilitate existing structures by building contracted spillways on the dam crest and adding discharge aprons and possibly energy dissipators at the dam foot. Ideally, the water discharged by these devices should be sub-critical when it reenters the stream channel.

As these structures age their failure risk will increase. This is primarily because of settling and shifting of rock within gabions, wire failure, the effect of falling rocks on exposed gabions, corrosion and other causes. The quality of rock used to fill gabions in Cape Verde is about midway between good and poor: excellent rock is blocky and hand-placed within gabions; poor rock is randomly placed round cobbles.

Rainfed agriculture. The project proposes contour agriculture on sloping land, some of which is steep. WARD will attempt to influence the mix of land uses -- agriculture, forestry, rangeland -- in ways that minimize erosion to within acceptable soil-loss tolerances. Initially, this will be by evaluating the effects of ground cover using SCUAF's hedgerow agroforestry soil loss model, or some other equally acceptable method. Eventually, runoff plot data will be available to further guide WARD's efforts.

Because WARD will implement techniques such as hedgerow agroforestry, stripcropping using agro-sylvo-pastoral species, and contour tillage, local concentrations of runoff may occur. These concentrations could lead to rills and gully formation if downslope protection is not a component of the farming system. Downslope protection will most often be in the form of hedgerow

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and stripcropped species which, if implemented correctly, will have a debris collecting and water spreading effect on runoff, lessening its impact. As stated in this text, there is an upper slope limit to the effectiveness of such interventions. Beyond that limit, rangeland and forestry are more appropriate land uses than cropping.

Groundwater. Most of Cape Verde's population relies on water from shallow wells for its domestic water supply. During drought years ground-water levels are shallow and well recoveries are slow. In several wells we observed well inflow limited to seepage along the contact zone between impermeable basalt and overlying channel alluvium; well recovery required 12 hours to raise groundwater levels 0.6 meter.

Reforestation efforts in Cape Verde rely extensively on mesquite. Mesquite is beginning to invade channel bottoms and could threaten water supplies during drought. WARD should monitor river bed vegetation and evaluate its effect on water supply. If a serious threat becomes obvious, then WARD may have to control phreatophyte density. Methods to remove vegetation should avoid chemicals that pose a risk to human or livestock health.

Many wells have unsanitary access platforms where livestock congregate and risk contaminating groundwater. WARD, as a community service, could improve the health of its project-area population by cementing the above surface platforms and walls that surround well openings. Several wells were observed that require cleaning.

MEASURED SOIL LOSSES

LAND USE	LOCATION	SLOPE (percent)	SOIL LOSS (t/ha/a)	CHANGE (percent)	CONTROL	SOURCE
Agroforestry	Japan	70		-99.7	Bare soil	Watnaprateep
Silvo-pastoralism	Indonesia	>50		-82 to 96	Trad. agric.	Proyek
Check dams (70)	Taiwan	54		0	No treatment	Chiun-Ming
Bare fallow	Burundi	40	880	control	Bare soil	Guizol
Maize + beans	Burundi	40	117	-87	Bare soil	Guizol
[illegible]	Burundi	40	332	-62	Bare soil	Guizol
Woodland	Burundi	45-50	<1	-100	Bare soil	Guizol
Bare fallow	Dominican Rep	20-50	1254	control	Bare soil	Veloz
Trad. corn + beans	Dominican Rep	20-50	133-187	-89	Bare soil	Veloz
Mixed crops, no till	Dominican Rep	20-50	2	-100	Bare soil	Veloz
Mixed, minimum till	Dominican Rep	20-50	46	-96	Bare soil	Veloz
Mixed with rock walls	Dominican Rep	20-50	163	-87.00	Bare soil	Veloz
Mixed with grass strips	Dominican Repub	20-50	133	-89.39	Bare soil	Veloz
Mixed, hillside ditch	Dominican Repub	20-50	127	-89.87	Bare soil	Veloz
Mixed, ditch + grass st.	Dominican Repub	20-50	81	-93.54	Bare soil	Veloz
Maize, up/down rows	El Salvador	30	127			Michaelsen
Sorghum in rotation	Taiwan	32	208			Hsu
Rhodes grass	Tanzania	18	0.04			Mitchell

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ANNEX D.3 FORESTRY AND SYLVO-PASTORAL ANALYSIS

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VI. WARD ELEMENTS

A. Continuing Support to DGCSAFER
B. Forestry, Agroforestry, and Sylvo-pastoral Research
C. Agroforestry and Sylvo-pastoral Development
D. Promotion of Private Sector Forestry Activities

Annex D.3 FORESTRY AND SYLVO-PASTORAL ANALYSIS

I. INTRODUCTION

A development priority in Cape Verde has been environmental stabilization in rural zones. Towards this end, USAID has been involved since the late 1970s in a series of projects promoting watershed management and development. While "biological measures" (usually afforestation) were regularly included as project activities, it was in the 1988 WDP Project Paper Amendment that tree planting was prioritized. By planting 3.5 million trees during the LOP, the project hoped to stabilize hillslopes thus protecting new engineering works in stream channels from excessive runoff and soil erosion.

Although substantial numbers of trees have been planted as part of GOCV and USAID efforts in soil and water conservation, much work remains in achieving environmental stability. Severe problems of soil erosion and uncontrolled runoff remain, particularly on marginal rainfed agricultural land. Water availability, soil stability, and agricultural productivity throughout Santiago will continue to depend on effective soil and water conservation measures. For this reason, this design team will give careful consideration to forestry, agroforestry, and management of sylvo-pastoral areas when developing the WARD implementation plan.

The following analysis will briefly review GOCV and USAID orientations and accomplishments to date in forestry and related disciplines. Work being done was evaluated for technical merit, the capacity and use of human resources, monitoring and planning, and technology transfer. General and specific conclusions were reached that will help guide WARD's areas and modes of implementation. Since one of WARD's objectives is continued assistance to DGCSAFER in soil and water conservation, past activities are identified that have proven to be valuable but will require further support. Determinations will also be made on new activities that will become part of WARD's implementation plan. Technical, financial, and institutional resources needed to implement priority activities will be defined.

II. TECHNICAL METHODOLOGIES

A. Findings

<u>Forestry Goals and Priorities</u>

After earlier efforts in Cape Verde to conserve soil and water primarily through structural improvements using rock and masonry, there has been a recognition of a parallel need to stabilize eroding slopes through vegetation management.

Vegetative measures used to promote soil and water conservation in WDP watersheds have centered around tree planting on both agricultural and non-agricultural land. The basic objective was to create a vegetative cover on slopes to reduce soil erosion and increase water infiltration.

An additional objective of tree planting, particularily for the Directorate for Forestry Services (DSF), has been fuelwood production. Over 80% of the population of Cape Verde obtains energy for cooking by burning wood or charcoal (The World Bank, 1989). In project watersheds, it is estimated that even with current rates of tree planting, fuelwood production will continue to fall significantly short of demand. Lacking a ready fuel source, rural populations resort to removing woody vegetation from steep slopes or burning crop residues. Both of these questionable activities are key contributors to soil erosion and the loss of soil fertility.

To date, tree planting has not resulted in fuelwood self-sufficiency but the trend appears to be greater balance in production versus consumption. Despite some pessimistic estimates, there seems to be significant progress being made in this regard -- prices of cut wood remain fairly low (although subsidized labor may keep the price artificially low) and fuelwood cutting permits are also reasonably priced.

Species Selection and Seed Supply

A criticism of forestry work on Santiago has been the limited diversity of tree species being used. Initially, tree planting centered on two species, *Prosopis juliflora* and *Parkinsonia aculeata*, the former valued for the quality and quantity of its fuelwood and the latter for forage production. However, the risks inherent to monocultures has made diversification advisable. *Acacia holosericia*, an Australian native introduced fairly recently, has proven well adapted in most climatic zones in Cape Verde and accounted for almost 40% of the trees planted by the end of WDP (WDP, 1990). The three species noted above still account for over 85% of trees planted. The FAO/Belgium Forestry Project produces seedlings of greater species variety but still plants substantially more *Prosopis* than any other species. Insufficient effort has been made to identify and promote other species which may also possess desirable qualities and produce valuable energy and non-energy products. Table D.3.1 illustrates the relative importance of species produced for afforestation work in the USAID project watersheds.

The WDP used a simple system to match species to site. Generally seasides are planted with *Atriplex*, arid zones with *P. juliflora*, and cultivated areas with *A. holosericea*. There are large monoculture plantations, primarily of *P. juliflora*, which increases the risks of disease or insect attack. Proven or

TABLE D.3.1: Inventory of Tree Species Produced, 1990

SPECIES	TOTAL	PERCENT
Acacia albida	8394	1
A. bivenosa	9410	1
A. cyanophylla	31085	4
A. holosericea	325572	40
A. molissima	970	<1
Atriplex spp.	2000	<1
Azadirachta indica	8019	1
Casuarina spp.	5681	1
Eucalyptus spp.	4482	1
Melia azadirachta	13034	2
Leucaena spp.	13146	2
Parkinsonia aculeata	41515	5
Prosopis juliflora	302781	37
P. cineraria	363	<1
Sesbania grandiflora	350	<1
Tamarindus indica	6753	1
Ziziphus mauritiana	7244	1
Other	27526	3

(Source: Watershed Development Project Final Report, 1990)

presumed shortcomings exist for each of these species. Atriplex provides adequate ground cover in saline environments but does not produce any other benefits such as forage. A. holosericea is the tree most readily accepted for agroforestry, possibly because of its small crown diameter (WDP, 1990). Information is scanty however on whether this species improves soil fertility. It also lacks secondary products such as fruits or fodder that would increase benefits to farmers.

The widespread planting of Prosopis is the cause of much debate among those supporting forestry work in Cape Verde. In some parts of the world, Prosopis is considered a weed that forms impenetrable thickets, difficult to eradicate or manage. This is felt to constrain the germination and growth of grasses for grazing livestock. To date, there is little visual evidence that this is occurring on Santiago. Older plantations are still open with only limited natural seeding or sprouting from adventitious root buds.

It is also held that Prosopis competes with crops for scarce groundwater. Although Prosopis does exploit deep groundwater with its impressive taproot, its leaf form indicates fairly low evapotranspiration potential. There is need for some research in the project zone to determine the degree to which this or other tree species deplete ground water resources on Santiago. It does seem logical that, given the low value of fuelwood compared to

water, fuelwood trees such as Prosopis should not be planted on or near irrigated land and existing trees in these areas should be cleared.

A constraint to efforts in tree species and variety selection is the non-systematic way in which seed is collected. Generally this process is done by undersupervised field crews who may not pay close attention to tree phenotype. Seed collectors would be inclined to harvest from those trees that are easiest to reach; this favors shorter, slower growing trees. The DSF does not yet have an adequate facility for seed sorting and storage. However, GOCV officials have said that the Fomento Agro-Pecuaria (FAP) is increasing its capabilities in seed multiplication and storage and could possibly provide services to the DSF. WARD should promote a collaborative effort with FAP to collect and store tree seed from preferred species and phenotypes.

Seedling Production and Tree Planting

The DSF operates its principle tree nursery at the Achada Sao Felipe facility. The WDP has also established smaller nurseries in each of the project watersheds. These were managed by DSF workers with oversight provided by the WDP forester. A typical nursery within a watershed will produce 10,000 to 15,000 seedlings per year of perhaps 10 different species.

Tree planting at fairly high densities has been concentrated in areas not suitable for cropping such as seasides, ridges, and arid zones. In the steepest areas, caldeiras (crescent-shaped microcatchments) are dug along contour lines; caldeiras are offset in the vertical direction to better trap runoff. On moderate slope, contour furrows are used instead of caldeiras. Trees are planted in pre-dug holes after the first substantial rain of the summer. When feasible, plantations are protected from animals by guards for two years after planting.

There have been incidences of low tree survival but it is apparent that this is mostly caused not by poor planting techniques but simply by insufficient rainfall after planting. In the sometimes harsh environments that are targeted for afforestation, seedling survival is never assured. In other instances, a particular species is not suited to the site selected for tree planting. For example, Prosopis and Parkinsonia have had high mortality in seaside plantations. Various species of Atriplex, a salt tolerant shrub, have had much greater survival rates.

Most trees planted by WDP are still quite young and are not yet ready for harvest or exploitation. Thus, the final step in the fuelwood cycle has not been officially implemented. The FAO/Belgium Forestry Project is supporting the formulation of harvest plans for other parts of Santiago and on Maio Island.

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This system calls for the removal of 60% of each tree (branches or stems of multi-stemmed trees) after 7 years and 40% of each tree after 15 years. After 25 years, 50% of the trees will be cut and replaced with seedlings.

To take advantage of the investment made in tree planting, harvest and marketing plans must now be formulated for maturing plantations in WARD watersheds. There are strong reasons for short rotation harvests. Prosopis coppices voraciously; once a root system is established it is almost impossible to kill. In addition, growth rates for stump sprouts normally far exceed those of mature trees. The harvest system being developed by FAO/Belgium could be modified or adopted in its present form for WARD watersheds. However, it is recommended that socio-economic and land and tree tenure studies first be carried out to define harvest and marketing systems that are socially, as well as technically, sound and sustainable.

Agroforestry and Fruit Production

Agroforestry can be described as the cultivation of trees (or shrubs) in association with crops or animals. Morever, the trees are planted as an integral part of cropping or livestock systems; systems made more viable by this integration (Foley and Barnard, 1984). Agroforestry seems well suited to Cape Verde for a variety of reasons. It can improve soil stability and fertility (both organic carbon and available nitrogen levels in soils increase in functioning agroforestry systems), provide insurance during years of crop failure, and furnish forage for high-value livestock and wood biomass for fuel (Young, 1987). However, only limited progress has been made in stabilizing cultivated lands through agroforestry.

There are USAID project sites where trees have been successfully integrated with banquetas (contour furrows) or arretos (contour rock walls). While farmers sometimes accept and appreciate tree planting in their fields, only low densities have been tolerated. Common is 10 meters between furrows and 5 to 10 meters between trees (100 to 200 trees per hectare). Canopy cover using such a system would mostly likely be less than 10%. Light tree density such as this cannot prevent substantial soil displacement during heavy rains. To make an impact in soil and water conservation, the DSF should make rainfed croplands the target of a determined agroforestry effort by developing and promoting more intensive, effective systems.

Fruit production for export and domestic consumption is among the more lucrative agricultural activities on Santiago. As an example, banana exports easily account for the greatest foreign exchange earnings from an agricultural product. The WDP played a modest role in developing fruit production in project watersheds. Limited numbers of fruit trees are produced and

distributed as a complement to tree planting for soil and water conservation. The RAP reports that in 1990 it distributed 8,200 seedlings of such species as: Mangifera indica, Carica papaya, Citrus sinensis, Citrus limonia, Anacardium occidentale, Persea americana, Tamarindus indica, Ziziphus mauritiana, Psidium guajava, Passiflora spp. (WDP, 1990). These trees are usually planted around dwellings or at the margins of agricultural areas. There appears to be great potential for expanding community-based fruit production and marketing. The interest and market certainly exist. More effort needs to be given to producing fruit tree seedlings and instructing farmers in how to plant and care for them.

Shrubs and Grasses

In some situations, shrubs and grasses are as important as trees in soil stabilization on steep slopes. Improving soil and water conservation on Santiago requires the establishment of vegetation cover on the steepest hillslopes where cropping is not or should not be practiced. Currently, hillslopes are contributing important forage for family-owned livestock. This vegetation is used in two ways: it is collected and carried to confined animals, or animals are allowed to graze and browse. Unfortunately, these activities denude slopes and thus increase rainfall runoff and soil erosion.

While range management and forage production are critical both in soil and water conservation and for supplementing rural incomes, USAID projects have only indirectly addressed these issues. In project tree plantations there usually is an attempt to exclude livestock for a period of time while seedlings become established. This is usually accomplished using paid caretakers rather than fencing and has resulted in some natural reestablishment of native grasses and shrubs. Much greater action is needed, however, to restrict cultivation and control grazing and forage collection in the steep slopes of upper watershed areas. The Forestry Code in Cape Verde calls for protection of such fragile, erodible areas; but implementing these regulations needs institutional determination and innovation, perhaps relying on techniques of community forestry or mixed state-community systems of protection and utilization.

Small fenced exclosures set up by INIA and the DGCSAFER also have demonstrated that recovery of damaged land is possible even without grass reseeding. Among the species most commonly seen regenerating in protected areas is Desmanthus virgatus, a shrub valuable for forage and fuel. Unfortunately, this shrub is reported to be unpopular with Cape Verdean farmers. Research is needed of the potential for reseeding protected rangeland with more acceptable grasses or shrubs. Once these lands return to ecological equilibrium, forage and fuelwood collection and controlled grazing can be permitted at prescribed intensities.

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A component in the pending IFAD Community-Based Agricultural and Livestock Development Project is the creation of sylvo-pastoral management areas. The IFAD Project would create 100 hectare enclosures with watering points, herder associations, pilot dairy enterprises, and improved veterinary care. The main goals of this effort will be to introduce to the project areas (afforested zones of Achada Beleia, Achada Mosquito, and Tarrafal) better techniques for herd management and the introduction of a participatory, community-based approach to livestock development.

Impact Assessment of Tree Planting

Most impact assessment is speculative due to the lack of a comprehensive watershed monitoring program. Many benefits derived from tree planting activities must be estimated or presented in non-quantitative terms. Tree plantations are felt to contribute to soil and water conservation in a number of ways. Tree canopies impede raindrop impact and decrease downhill soil movement during storms. Rain water flowing down tree trunks has a greater infiltration rate and thus does not contribute as much to erosive stream flow. The root systems of trees and reestablished shrubs and grasses can physically stabilize the soil (Pereira, 1989).

Data from similar environments in other countries are useful for comparison. It has been reported in Burundi that woodlands lose about half as much soil to erosion as do bare fallow control plots (Guizol, 1982). Approximately the same difference was measured in agroforestry zones in Japan when compared to bare fallow (Watnaprateep, 1980). However, no empirical data have as yet been collected in Cape Verde to support or refute these types of estimates.

A undeniable benefit of planted trees is their contribution to fuelwood production in project watersheds. It has been roughly estimated that a Prosopis plantation of 5 x 5 meter spacing yields about 1.25 tons/ha/yr in Cape Verde (Egli, 1989). If this is reasonably accurate then the trees planted by the WDP are producing about 7,500 tons of wood per year worth about $600,000. This wood is obviously not all available for public consumption but these figures illustrate the potential value of fuelwood yields.

There are numerous other benefits for which quantification would be quite difficult for lack of data. Cape Verdeans obtain forage, fruits, pods, nuts, medicines and other secondary products from trees planted by WDP. Other benefits even more difficult to quantify include: shade for dwellings, temperature moderation, wind interception, visual aesthetics, habitat for wildlife, and others. Possible negative impacts include competition for land and water resources and soil nutrients.

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B. Constraints and Opportunities

The FAO/Belgium Forestry Project mentioned above supports many activities within the DSF. Their specialists work with Cape Verdean counterparts in nursery production, forestry planning and mapping, mensuration and inventory, harvest plans and fuelwood sales, and training. Although their emphasis has been on Prosopis plantations for fuelwood, they are researching other species and have started a program in community forestry. With more numerous TA and closer interaction with DSF staff, this project has had a much greater role in institutional development than had WDP or could be expected from WARD.

WDP attempted to complement the work of the DSF (and FAO) by integrating forestry with rural engineering to better address the issue of soil and water conservation. However, much of the WDP forestry component evolved into mass tree planting in a style similar to the work being supported by FAO. This created a redundancy in technical support provided by the two donors, although the projects were geographically separate for the most part.

To make an sustained impact in the forestry sector, USAID must once again look for ways to complement the areas of competency in the DSF, while avoiding conflict with FAO efforts. This must also happen within WARD goals and objectives, which call for activities directly promoting agricultural production. Three areas of opportunity are agroforestry, fruit production, and rehabilitation and management of sylvo-pastoral areas.

However, local resources available for these types of activities are currently inadequate. An office is needed in the DSF concerned only with agroforestry activities. One or two foresters should be selected and sent to suitable universities for training in agroforestry principles and techniques and in principles of social forestry. Research is needed to develop workable agroforestry systems and to find tree and shrub species that would be acceptable and valuable to farmers.

There also could be significant farmer resistance to intensive agroforestry. Trees are seen to conflict for limited land resources with cultivation of corn and beans. Given the tenuous financial conditions and small land holdings of rural families, the risks of change would be difficult to accept. But along with proven agroforestry technologies, acceptance and voluntary cooperation by farmers is necessary for an agroforestry program to be successful. WARD, drawing upon the research and extension community, is in a good position to promote agroforestry through field trails, demonstration plots, extension, and training for farmers.

Likewise, WARD could use its resources to accelerate the

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production and sale of fruit trees. Fruit and fruit trees enjoy undisputed popularity with rural families and contribute substantially to rural economic activity. Obstacles such as poor transport, processing, and storage infrastructure will make expansion of fruit production difficult. The opportunity exists during WARD to investigate and promote better systems for growing and marketing fruits and other tree products.

The majority of rural households on Santiago raise livestock; expending a considerable amount of time and resources and deriving significant family income from the activity (Finan and Belknap, 1984). Livestock (mostly goats) is allowed to graze and browse freely on fallow, uncultivated, or marginal land. It is also common for hillslopes to be cleared of virtually all organic matter to be used later as animal feed. As a result, range condition over much of Santiago is poor which contributes to excessive runoff and soil erosion.

A constraint to successful intervention in sylvo-pastoral areas is the paucity of information available on productivity or carrying capacity of Cape Verde's rangelands. Later in this analysis is a sample list of research topics which could provide valuable information for better rehabilitation and management of Santiago's rangelands. Avoiding redundancy with the IFAD Project, WARD will coordinate collaborative programs with INIA and DGCSAFER to develop and implement improved management systems for pastoral resources.

III. HUMAN RESOURCES

A. Findings

Donor Assistance

Mentioned earlier in this report, the FAO/Belgium Forestry Project is the primary source of donor support to the DGCSAFER DSF for work on Santiago and Maio. Initiated in 1978 and currently in its third phase (1989-1993), the project maintains a large ex-patriot staff to work with Cape Verdian counterparts at national DSF headquarters at Achada Sao Felipe. The project seeks to improve the DSF's administrative and planning capacity as well as its technical capabilities in seedling production, plantations, and fuelwood harvest. In additional, the project conducts research in such topics as nursery techniques, site preparation, and species trails. Both in-country and international training is supported although no degree programs are funded. The UNDP, EEC, and Swissaid are other donor groups supporting modest afforestation activities on Santiago.

Public Sector Involvement

At the Achada Sao Felipe facility, the DGCSAFER DSF employs approximately 6 engineer-level professionals, 4 mid-level professionals and 8 technicians in forestry and/or natural resource management. The engineer-level staff generally have university degrees and periodically attend short-courses and workshops to upgrade their skills. In numbers, this level appears to be adequately staffed to handle most DSF management tasks. The number of mid- and lower-level personnel appear to be inadequate for their tasks of field supervision and technical oversight. WARD will review staffing needs at these levels and propose training as needed. Many of these techicians receive technical training at the INIA Training Center; their curriculum includes forestry and rural engineering classes as well as math, chemistry, languages, and other topics. As these agents often provide the only reliable quality control for field work, their skills need to be upgraded through yearly workshops and technical courses. WDP has conducted a number of such courses and also has sent participants to courses sponsored by the FAO/Belgium Project. The opportunities for in-country technical training appear to be adequate for most of WARD project needs.

An important secondary objective of tree planting has been to provide employment to rural populations. According to WDP reports, rural Cape Verdeans contributed over 285,000 person days of labor as paid participants in nursery management, site preparation, seedling transport, and tree planting. This labor force is provided both by normal workfronts and community-based workfronts. Many of these positions are filled by unskilled laborers although nursery managers and <u>controladores</u> (workcrew foremen) receive some technical training and generally maintain their positions from year to year.

Due to a variety of factors, primarily the unsustainability of funding labor with PL 480 proceeds, WARD will gradually diminish the number of person months of labor employed in forestry activities. Within five years, this quantity should reduce from about 12,000 person months to about 6,000 person months per year. This reduction will coincide with the transfer of tree planting responsibility from the project to the DSF of certain regions within project watersheds. As investment in labor declines, new opportunities will develop for use of the proceeds from PL 480 grain sales. These opportunities, which should provide alternate sources of income for rural families, could include seed money for micro-enterprises, risk insurance for farmers trying improved farming systems, or credit for investment in agricultural infrastructure.

Although WARD will not directly implement rural enterprise development programs, it will provide support to RAP in these activities and will contribute further by collecting base-line data and conducting feasibility studies. Two potential sources of TA to support this important element are the PVO eventually

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chosen to manage the PL 480 food aid program and the U.S. Peace Corps which has an active program on Santiago. The WARD Consortium will need to coordinate with either or both of these organizations early in the project to develop an action plan and identify personnel needs.

Community Involvement

The WDP has made efforts to enlist public assistance and support in watershed development activities. Through the Rural Assistance Program (RAP) a limited number of community-based forestry activities are being conducted. The RAP manages small community nurseries and distributes seedlings (usually fruit trees) to the rural population for a nominal fee. These trees are usually planted next to dwellings and rarely in locations that would promote soil and water conservation, such as along contours in croplands. The free distribution of plants or seeds for the leguminous, perennial shrub Cajanus cajan (Congo bean) has been more readily accepted by farmers and this species can be seen growing in most agricultural areas. Generally however, it must be said that voluntary tree planting by individuals or community groups is not having a measurable impact on soil and water conservation on Santiago.

Private Sector Involvement

A key concept in the new government's program is decentralization and private sector involvement in activities once solely controlled by the public sector. Of major potential impact to WARD's long-term success is the GOCV plan to privatize such services as civil works and forestry.

There is little evidence of private enterprise involvement in forestry activities (excluding sales of fruit and other tree products) in Cape Verde besides some sales of potted ornamentals in Praia markets and fruit tree seedlings sold below cost by the RAP. The DSF has a monopoly on commercial fuelwood cutting and sales although a system is being considered to contract wood cutting with payment at 1.5 escudos per kilogram. Wood is currently harvested from large government-owned plantations using work front labor and sold at 6 escudos per kilo. The low price of government fuelwood and ease of obtaining wood illegally make it unattractive for private Cape Verdeans to be involved in fuelwood production for sale. The private sector does have a strong involvement in marketing other tree or forest products such as fruits and fodder.

B. Constraints and Opportunities

While many capable Cape Verdeans work for the DSF and complementary departments, there remains a number of key specialties in which trained persons are needed. A rather high

attrition rate in these departments has further complicated the task of maintaining a trained, experienced staff. Personnel needs in the short-term include specialists in agroforestry, social forestry, and sylvo-pastoral systems. The WARD training consultant will be able to determine other training needs based on specific project elements, gaps in DSF staff, and training plans of the FAO/Belgium Project. The WARD project will have funds available to provide further training opportunities for new DGCSAFER employees and to upgrade the capabilities of current employees through short courses, seminars, and workshops.

For a program in natural resource management to be successful and sustainable, a voluntary commitment by the rural populace is essential. Certain WARD elements, like many USAID activities undertaken in the past, will impact on the rural populace of Cape Verde. But the challenge remains of how to truly implicate these supposed beneficiaries in the conception and implementation of field activities. Both FCRP and WDP were technically-oriented projects with only minor investment in community development. WARD follows much the same track. However, there are substantial expectations about farmers "cooperating" in field trials of agroforestry and farming systems, testing of new crop varieties, various micro-enterprises, etc. For WARD to achieve its goals, great care must be taken to provide farmers with more than a demonstration, a lecture, or a new crop variety. They will need to be enlisted as partners in the activities WARD proposes.

At odds with the government plan to decentralize DGCSAFER responsibilities, is the lack of a strong history of private sector involvement in forestry-related activities. Potential entrepreneurs will almost certainly be reluctant to accept the risks of starting businesses which have no successful local models. A system of cost sharing or incentives may be necessary to encourage interested entrepreneurs to invest time and finances in such ventures. Examples of small enterprises that the project could promote are: a) contract seedling production, b) contract seedling planting c) contract wood cutting, d) beekeeping for honey, e) commercial fruit and nut production, or f) local manufacture of planting pots or gabions. The WARD project will be in the perfect position to provide technical support as Cape Verde moves to decentralize forestry activities.

IV. WATERSHED PLANNING

A. Findings

The DSF, with assistance from the WDP and FAO projects, maintains fairly good records of basic data such as numbers and species of seedlings produced and planted. Maps of Santiago indicate location, species, and age of tree plantations. The WDP

has implemented a MIS to assist in collecting, loading, analyzing, and displaying data. A valuable tool for forest inventory would be an accurate set of aerial photographs. These could be used for structure and forest inventory, estimation of tree cover, planning, and comparison of land condition with older photographs. It has been reported that FAO is committed to financing a new set of photographs of Santiago and has scheduled flights for autumn 1991.

Much DGCSAFER effort during the WDP went into the creation of Phased Watershed Development Plans (PWDP) for each of the project watersheds. DGCSAFER staff report that plans are complete for 6 out of twelve WDP watersheds. The purpose of the plans is to establish long-term timetable to optimize investment levels for DGCSAFER interventions in project watersheds. These will be based on all measurable biophysical and socio-economic criteria using data collected both by project and non-project personnel. A methodology has been devised for the compilation and analysis of data and the definition of a suitable work sequence. These plans are specifically suited to establishing global priorities -- an important role given the non-scientific nature of past watershed planning. The DGCSAFER now has available the methodology, equipment, and expertise to complete and use these plans.

For more site-specific work plans, the planning process is more subjective. Work priorities are often based on the whim of the supervisor or the availability of work crews. There are inadequate channels of communication between the Forestry and Rural Engineering Divisions when work plans are being created. There seems to be a need for a more practical planning methodology with better collaboration between offices.

Substantial investment has gone into developing a workable Geographic Information System (GIS) for use in DGCSAFER planning. The system currently in place has substantial drawbacks. It is not user-friendly nor does it make use of the up-to-date software sold commercially at reasonable prices that facilitate data-base loading and manipulation. And even if a functional GIS were installed, DGCSAFER staff is currently inadequate in numbers and training to run the system. Granted, a workable GIS system would be helpful in assimilating data from disparate sources for creating watershed plans. But the potential benefits to DGCSAFER are not worth the additional expense in first installing and then managing such a system.

B. Constraints and Opportunities

Watershed management planning is a complex operation that requires solid leadership, trained personnel, accurate and complete data, cooperation and integration of a multitude of government offices, and active participation of rural

communities. These criteria may or may not be attainable on Santiago. Key constraints to integrated planning include: a) inadequate communication and cooperation among Rural Engineering, the DSF, the Water Resources Board, and government offices responsible for socioeconomic studies; b) lack of a watershed monitoring system for data collection; c) planning staff spread too thin; d) disagreement as to where the overriding authority for watershed planning should rest; and e) a labor force working through different lines of authority.

A basis for watershed planning has been established with the creation of Phased Watershed Development Plans. WARD will support continued efforts to refine the planning process and to proceed to the operational stage. By targeting sub-watersheds in Ribeira Seca, the project will have an excellent opportunity to develop and test models for intervention. The complexity of these plans will need to reflect the capacity and level of interest of GOCV counterparts. These efforts will produce a methodology that can be integrated into the government agency eventually charged with watershed development planning.

V. TECHNOLOGY TRANSFER

A. Findings

Technology transfer, or the combined efforts of research and extension, has not been practiced intensively in the forestry and sylvo-pastoral disciplines. To a limited extent, the WDP project forester conducted species trials looking for adaptation to specific environments but these studies could not be described as statistically sound or exhaustive. A forestry researcher sponsored by the Henry Doubleday Research Association and in residence at INIA has contributed to studies deemed important by the WDP but this has been on a part-time basis. INIA does have new research capabilities in forages and range management that may have future relevance to WARD activities. The FAO/Belgium Forestry Project conducts some research on seedling production, tree growth and other topics, but they are neither institutionalizing research capability in the DSF nor developing a relationship with INIA to do forestry research.

The institution with the greatest involvement in forestry extension has been the RAP. RAP extensionists instruct rural participants in nursery management, tree planting, tree care, and proper methods for pruning and harvest. These agents are not trained foresters but they do benefit from periodic training in forestry techniques. The DGER expresses interest in becoming involved in agroforestry and sylvo-pastoral extension but they do not have trained extensionists in these areas. They do expect to provide assistance to the sylvo-pastoral components of the IFAD project mentioned previously.

B. Constraints and Opportunities

The DGCSAFER does not have substantial research capabilities nor the time and resources to commit to forestry research. The conduct of research in forestry, agroforestry, and sylvo-pastoral systems will have limited professional support from INIA. Historically, there has not been a spirit of close cooperation between the DGCSAFER and INIA. Such a cooperative spirit will be necessary to create and maintain collaborative research programs. The WARD project can help create an atmosphere of cooperation as it supplies support to both institutions. INIA research plots in project watersheds, will need to make use of technical assistance and labor provided by the DGCSAFER.

There is clearly a need for a focused research effort to address a variety of topics including field testing of many tree species and provenances throughout the geographic range of forestry activities. Several topics that could be targeted for research are:

* Socio-economic study and market survey for fuelwood and secondary tree products.

* Study of seedling survival, correlated to species, site quality, method of site preparation, rainfall, etc.

* Estimation of tree growth and yield of wood and other products correlated to species, site quality, rainfall, and other variables.

* Determine economic rotation age of primary fuelwood species to maximize biomass production.

* Research harvest systems to maximize wood production without sacrificing goals of soil and water conservation.

* Species and variety trials of trees and shrubs to diversify planting for fuelwood, forage, and agroforestry.

* Species and provenance trials to find additional salt-tolerant trees and shrubs suitable for seashore planting.

* Broad investigation of integrated agroforestry systems for rainfed land in lower and upper watersheds which will serve the following purposes:
    * stabilize the soil and increase soil fertility
    * provide a good fuelwood
    * provide valuable non-energy products
    * acceptable to farmers

* Study of natural regeneration in rangelands.

* Analysis of the nutritive quality of the common rangeland grasses and shrubs such as Desmanthus virgatus.

* Determination of range carrying capacity for livestock.

* Field trials of grasses and shrubs for range revegetation.

VI. WARD ELEMENTS

Element 1: Continuing Support to DGCSAFER

PROBLEM -- Despite progress during WDP, the DSF needs further support for revegetation work in project watersheds. Integration of WDP responsibilities into the corresponding Cape Verdean Departments also has not been completed. Finally, as DGCSAFER undergoes the changes initiated by the new government, there will be many institutional issues that WARD can help resolve.

CONSTRAINTS -- There are several obstacles to a smooth integration of WDP/WARD forestry activities into the DSF. USAID competes with other donors in providing assistance to the DGCSAFER and DSF. WDP also worked most closely with the DGCSAFER General Directorate which, to a great extent, works independently of the DSF. Lastly, WARD will have fewer financial and human resources to commit to forestry activities.

ALTERNATIVES -- Discontinue USAID support to management and oversight of forestry work in project watersheds. Allow the DSF to assume management responsibilities as per GOCV priorities.

RATIONALE -- USAID has made an investment in the physical and social development of a large portion of Santiago Island. The shock of an abrupt termination of support is unwarranted. Although the technologies developed and used in forestry can now be passed to Cape Verdean counterparts, this must be done on an official and structured basis.

WARD ACTIVITIES -- 1) Oversee tree nurseries, site preparation, and planting of 3 million trees in project watersheds. 2) On a watershed by watershed basis, pass management responsibilities to the DSF. 3) Work to integrate WDP accomplishments in record keeping and planning into the DSF.

REQUIRED INPUTS -- A long-term watershed manager/natural resources specialist will serve into year four of the project. Along with numerous other responsibilities, this person will oversee WARD tree planting and facilitate its integration into the DSF. A list of commodities required to support the forestry program is detailed in Section III.D. Training will also be provided to increase the ranks of mid-level technical supervisors and to increase skills at all levels.

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Element 2: Forestry, Agroforestry, and Sylvo-pastoral Research

PROBLEM -- With continuing environmental degradation and shortfalls in agricultural production (despite large donor development investment), Cape Verde needs innovation in its approach to land management.

CONSTRAINTS -- Geographically remote and socially and culturally unique, Cape Verde cannot depend on the international research community to find solutions to local problems. INIA and other research institutions in Cape Verde do not have broad capabilities in natural resources research. There has not been close cooperation among INIA and implementation agencies such as DGCSAFER.

ALTERNATIVES -- In developing countries, research in forestry-related disciplines is often given low priority. The most likely alternative to USAID involvement is continuation of the status quo of disjointed, often unshared, research conducted by INIA (with Henry Doubleday assistance) and various projects with interest in the forestry sector. The IFAD project proposes new technologies for both rainfed cropland and sylvo-pastoral zones, but the project design does not call for research or field testing -- the technologies proposed are adaptations of existing systems or ideas from other countries.

RATIONALE -- Given the critically limited species diversity of trees planted on Santiago, field testing of new or underutilized species is essential. WDP largely avoided intensive soil and water conservation work in cropping zones due in part to a lack of proven technologies to promote in these areas. Research is needed to protect the investment made in developing irrigated croplands and to continue the task of environmental stabilization. The institutional capacity do these tasks can be increased significantly through WARD.

WARD ACTIVITIES -- 1) Collaborative applied research investigating new species of trees, shrubs, and grasses for use in Cape Verde. 2) Socio-economic study of fuelwood, secondary tree products, and livestock industry. 3) On-farm trials of agroforestry and agro-sylvo-pastoral systems.

REQUIRED INPUTS -- Recurring technical assistance will work with WARD project management and with INIA and DGCSAFER officials to establish a research plan and to begin field work. Since INIA and DGCSAFER both lack trained professionals in agroforestry, WARD will sponsor degree training for one person from each institution in this area.

Element 3: Agroforestry, Fruit, and Sylvo-Pastoral Development

PROBLEM -- Rainfed cropland and steep rangeland in upper

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watersheds are the zones on Santiago most prone to excessive rainfall runoff and soil erosion. Valuable irrigated cropland and large structures in stream channels are at risk until interventions successfully stabilize these areas.

CONSTRAINTS -- While quite competent in establishing and managing fuelwood plantations, the DSF does not have strong programs in agroforestry or social forestry. Nor does this or any other local institution work extensively in the areas of livestock, forage and fodder, or range management. Many of the activities noted above will require skills for which the DSF does not yet have trained people. Implicating farmers in initiation and implementation of field work will be constrained by weak extension services.

ALTERNATIVES -- The IFAD project will implement improved systems in rainfed agricultural zones, possibly providing an alternative to USAID involvement. However, the zone of activity is limited to 3 sub-watersheds within Ribeira Seca -- insignificant in relation to total surface area of rainfed cropland. What IFAD may do is strengthen the DGER's ability to extend improved cropping systems for rainfed zones.

RATIONALE -- While building structures and planting trees have had positive impacts in stabilizing the watershed environment, an obvious obstacle has been the lack of successful intervention in rainfed cropland. This intervention is essential to protect past investment and to positively impact agricultural productivity. Without WARD involvement, these activities would remain without an institutional home and would continue to receive low priority.

WARD ACTIVITIES -- 1) Develop demonstration sites of improved cropping integrated with hedgerows or other agroforestry systems. 2) Work with extension personnel to recruit farmer participation in treating rainfed cropland with improved systems. 3) Promote better production and marketing strategies for fruit and other tree products. 4) Produce and distribute greater numbers of fruit tree seedlings.

REQUIRED INPUTS -- Recurring technical assistance in agroforestry, extension, and the social sciences will work with WARD project management and DGCSAFER forestry and extension personnel to establish and implement the activities described above. Since DGCSAFER lacks professionals in agroforestry and sylvo-pastoral systems, WARD will sponsor degree training to one person from each area. WARD will also prioritize practical training for field technicians and farmers in these areas.

Element 4: Promotion of Private Sector Forestry Activities

PROBLEM -- The recognized inefficiency and unsustainability of public sector monopolies and new government orientations towards

decentralization have made private sector involvement in natural resources management a potential trend for the future. However, the Cape Verdean private sector is unprepared to accept this challenge.

CONSTRAINTS -- In Cape Verde, the government has controlled the management and implementation of most activities in forestry and natural resources management since the colonial period. There may be a reluctance to relinquish authority to the private sector. Additionally, the private sector is poorly developed, specifically with regard to forestry-related enterprises or the marketing of tree products.

ALTERNATIVES -- Given that WARD plans to diminish the use of work front labor, alternative ways to pass benefits to rural communities should be considered. One alternative would be allow farmers to find their own alternate sources of income. A more positive approach would be to provide TA to promote private enterprise and other community development technologies. The PVO eventually chosen to manage the PL 480 food aid program or the U.S. Peace Corps would be in a position to provide community-level TA. RAP could also be developed through training and institutional support to promote micro-enterprises

RATIONALE -- Both general A.I.D. policies and USAID/Praia strategies call for support to the private sector. USAID/Praia is also considering ways to reduce investment in unsustainable "pay for work" labor forces. To replace that mode of investment, WARD should promote other, more sustainable, sources of rural income. But given WARD's already diverse activity list, involvement should be limited to support for the RAP, Peace Corps, or other collaborating agencies.

WARD ACTIVITIES -- 1) Conduct a feasibility study of the potential for private sector contracting for tree seedling production, tree planting, and fuelwood harvest and marketing. 2) Study existing micro-enterprises working with forest or range products and evaluate the potential for new ones to develop. 3) Assist organizations such as the Peace Corps in promoting small enterprise development to increase rural income.

REQUIRED INPUTS -- Recurring TA in the areas of private enterprise development, rural sociology, and extension will work together with local institutions. Training of extension personnel and new entrepreneurs will be a priority. Financial assistance to help establish small businesses may prove necessary and could be available through excess PL 480 proceeds.

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ANNEX D.4
SOCIAL SOUNDNESS ANALYSIS

SOCIOCULTURAL CONTEXT

General Cultural Context

Unlike the vast majority of African countries, Cape Verde is fortunate in enjoying virtual linguistic, ethnic, and religious unity. The national language is Portuguese, the local dialect of which is known as crioulo. According to one estimate, 70% of the population represent a racial mix of African and European (primarily Portuguese) groups; some 28% are of more purely African descent; and the remainder are of largely European origin. Despite this mosaic, racial tensions appear to be minimal. Although differences in socioeconomic class are readily evident, these do not seem to pattern sharply along racial lines. (However, consult Meintel 1984.) Finally, informal estimates indicate that some 96% of the population is nominally Catholic. In sum, Cape Verdeans share an exceptionally favorable cultural environment for undertaking concerted development action.

Demographic Context

The demographic picture is not so bright, however. Provisional results of the 1990 national census (MPC 1990:1) confirm a marked increase across the past five decades in the number of inhabitants in Cape Verde. On a land base about the size of Rhode Island, the resident population has more than doubled from its 1950 level of 148,331 to today's 336,798 (MPC 1990:5), despite reportedly heavy emigration throughout this period. Because of both internal and external factors, however, emigration rates reportedly are slowing. Combined with a fertility rate of 37 per 1000 (DGP 1990:15, 1987 data), population pressure promises to continue its upward trend for some time. The natural growth rate is currently estimated at 2.7% and is expected to reach 3% by the year 2,000 (NA n.d.-a:1). Even with continued emigration, this is a frightening figure.

According to 1990 national census data, 47% of resident Cape Verdeans live in urban or semi-urbans areas (MPC 1990a:unpaginated). Urban populations are currently growing by 4.4% annually (calculated from MPC 1990a); reportedly, they are rapidly outstripping the employment opportunities and utilities available in towns and cities. This trend is due primarily to rural exodus stimulated by the combination of population pressure on limited agricultural land and the recurrent and often severe droughts that characterize Cape Verdean ecology and lead to frequent crop failure.

The new census indicates that 52% of the population are female and 48% male. However, the economically active population is about 60% female (USAID/CV 1990). In any case, sex ratios alone do not give a complete picture of rural demographics. Because of the emigration of adult (and usually more skilled) labor, Cape Verde has one of the highest dependency ratios in Africa (USAID/W 1988). The age profile is highly skewed in that 46% of the population is under age 15 (USAID/W 1988:3). For rural Santiago Island -- where the proposed project is to be implemented -- the result is a total of 42% female-managed agricultural families on Santiago (MDRP 1990:57). Taken together with population pressure on a very fragile and sharply delimited land base, these demographics make for a difficult life indeed as Cape Verdean farmer-stockraisers seek to wring an existence from their delicate agroecology.

Political-Economic Context

Cape Verde represents a unique economy that has been, and remains, very open to the world economy. But given a congeries of unlucky factors -- among others, the country's geographic isolation, small size, sparse and erratic rainfall regime, fragile ecology, and generally low agricultural productivity -- Cape Verde has a highly dependent economy in which its foreign exchange needs and balance of payments deficit are met almost entirely through two sources: remittances from the large numbers of Cape Verdeans living and working abroad; and foreign aid, including food aid. Domestic exports cover only some 3% to 7% of import costs; and food imports account for 70%-90% of consumption. For details of the macroeconomy and foreign aid, consult USAID/W 1988, DGP 1990, NA 1988, and USDC 1990.

Cape Verde won its independence from Portugal in 1975. Between 1975 and 1991, the country was governed under a single-party system -- the Partido Africano para a Independencia de Cabo Verde (PAICV). While remaining open to the world economy, the PAICV also continued earlier Portuguese-inspired civic measures in its internal economy. In particular, the PAICV placed great emphasis on public-sector investments in development infrastructure such as roads and schools. In rural areas, infrastructure development has additionally focused on erecting both large- and smallscale soil and water conservation (SWC) structures and carrying out vast afforestation programs. Most of these efforts have relied upon state-organized "workfronts," i.e. workgangs mounted to do manual labor. Workers are paid in cash derived primarily from government sales of PL480 food aid and other donor sources (see relevant sections of PP).

In January 1991, the PAICV held the first free, multiparty elections in Cape Verde's 16-year history. To its surprise, the PAICV was unseated by the newly organized MPD (Movimento para Democracia). The MPD -- which took office in March 1991 -- is

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committed to greater economic liberalization. It vigorously espouses private enterprise over public or parastatal investment, and is laying wide-ranging plans for moving toward the private sector as the engine of change in many economic arenas. Ultimately, too, the MPD would like to see a gradual reduction in Cape Verde's dependence on external assistance.

Because of the MDP's understandably cautious approach to overly abrupt change, for the immediate future the new government plans to continue to deploy public workfronts in developing SWC infrastructure and forestry resources in rural areas. The rationale behind this strategy is multifold. In the short run, this use of food aid aims to ameliorate chronic un- and underemployment, which in the nation as a whole is estimated at 70% of the working-age population (USAID/W 1988:9, USDC 1990:5). Agricultural families in particular have few other income-earning opportunities during the 9-month-long dry season. For the vast majority of rural families (and particularly for single-female-headed households; see below), neither cash earnings nor food production from cropping and stockraising under current agroecological and technological regimes are adequate for meeting yearround subsistence needs. Monetized food aid has been chosen over direct food aid for a variety of carefully considered reasons. Paramount among them are the tangible development possibilities that creation of critical infrastructure provides, and the avoidance of a welfare mentality and loss of human dignity.

In the long run, however, the GOCV professes to see workfronts as only one step toward the national goal of placing agriculture, rural livelihoods, and ultimately the country's economy on a more secure footing. In broad outline and based on PP team interviews with numerous individuals in Cape Verde, GOCV aims and means appear to involve the following.

1. Via public-sector investment in SWC infrastructure, to restore, improve, and stabilize the natural resource base on which crop, livestock, and forestry production depends.

2. Through judicious, case-by-case agrarian reform and other legal efforts (including review of national codes for forestry, water, land-use/soils and possibly livestock) that are tantamount to elaboration of an integrated plan of environmental law, to consolidate and rationalize farmers' and stockraisers' access to these improved productive resources.

3. At the same time, with more sophisticated and systematic family planning programs supported by a multi-donor coalition, to relieve both rural and urban population pressures.

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4. With enhanced research, extension, community-organizational, and other efforts, to test/adapt and disseminate improved cropping, stockraising, and forestry varieties, techniques, and systems that are:

   - sustainable, i.e. ecologically stable and less demanding than present crop mixes and land uses;
   - higher yielding;
   - nutritionally superior;
   - have higher value on internal markets, so as to stimulate both rural and national economies;
   - relatedly, can lead to rural, microenterprise, or export industries;
   - shift imports of foodstuffs from more to less expensive commodities.

   Ideally, any agrosylvopastoral innovation should embody as many of the foregoing characteristics as possible.

5. In order to achieve many of the above aims, to strengthen national institutional capacity for expressly applied agricultural RD&E (research, development, and extension).

6. To promote secondary rural enterprises that generate alternative employment opportunities.

THE WATERSHED APPLIED RESEARCH AND DEVELOPMENT PROJECT

WARD addresses a number of the issues enumerated above, and in so doing clearly advances GOCV policy, planning, and development initiatives in many critical arenas. In addition, it nicely complements and/or bolsters other USAID/CV programs and strategies (e.g. in economic reform/private sector promotion, family planning, and human resource development) as well as other donor efforts in Cape Verde (e.g. the upcoming IFAD project). More specifically, WARD will make significant contributions to 1, 4, and 5 above, and indirectly to 6.

The goal of WARD is to increase agricultural production and concomitantly to increase and/or place on a more sustainable or independent footing producers' incomes. WARD builds upon two earlier USAID/CV initiatives: the Watershed Development Project (WDP) and the Food Crops Research Project (FCRP). Many lessons pertaining to the social soundness of the WARD project are to be learned from its predecessor projects, and these lessons are woven throughout the text below. WARD represents an exciting opportunity for real development and positive "people-level" impacts in Cape Verde, given that the political climate for democratic and sustainable development is more favorable than ever before in this young country's history.

BENEFICIARIES

Background Data

According to the nationwide agricultural census of 1988 (MDRP 1990:28), of three major categories of agrarian groups in Cape Verde, one -- "agricultural families"[1] -- comprises 99.8% (32,193 out of a total 32,265) of all agricultural production units in the nation. In the aggregate, these families constitute WARD's primary beneficiary group. While WARD is expected to have nationwide impacts in the long run, implementtion will be centered on Santiago, the largest of Cape Verde's nine inhabited islands and the headquarters for the country's research and extension services.

Santiago Demographics. Santiago is home to fully 51% of Cape Verdeans (MPC 1990) and 18,000 or 56% of the country's agricultural families, as defined in MDRP 1990. Many more rural Santiagans are at least partially active in agriculture. As calculated from the 1988 agricultural census (MDRP 1990:39), Santiago also accounts for 57% of the country's cultivated land, and informal estimates place its production at some 50% of Cape Verde's total agricultural output. (The agricultural census gives no figures for rangelands or purely pastoral production, however. For further land use detail, see other PP analyses and below.) While population density nationwide is 84 persons per km^2, for Santiago this figure is 173. Stresses on environmental and agricultural resources are thus commesurately greater. By the same token, WARD activities on Santiago can have a proportionately larger impact on national well-being.

Some 55% of Santiago's inhabitants reside in rural areas, where they practice three broad types of agriculture: rainfed, irrigated, and mixed irrigated/rainfed. The number of families falling into each of these broad categories is 76%, 1%, and 14%, respectively (calculated from MDRP 1990). The agrarian population lives in closely-knit "localities," community units comprised of villages or territorial neighborhoods. Until the recent change in government, these units were under the authority of a comissao de moradores 'residents' commission' headed by a PAICV responsavel. As yet, no alternate on-the-ground politico-organizational structure has been created to fill the void left by the change in government. However, there is speculation that a similar sort of system may be set up, but now with democratically elected local leaders.

Land Tenure. Five principal types of access to land can be distinguished among Cape Verdean agricultural families (MDRP 1990:25). According to this source, on Santiago Island outright ownership is enjoyed by only 34% of agricultural families. Both landed and landless producers may engage in sharecropping,

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traditionally with a 50-50 split of production between owner and sharecropper. The agricultural census indicates that 15% of Santiago farmers practice sharecropping. However, due to strictures in the aborted agrarian reform law making sharecropping illegal, this figure is likely considerably deflated. Some portion of sharecropping may go unreported or be disguised as rental (reportedly 46% of Santiago families). Rental may be paid in cash or kind. On the whole, Cape Verde producers prefer sharecropping to rental. While the latter is a fixed rate, in poor agricultural years, sharecroppers are often excused from any payments to landowners. Three further kinds of access to land are: de facto usufruct, in which people utilize state-owned land to which they do not have legal title but on which they may have longstanding squatter status (4%); de jure usufruct, in which producers have obtained legal use rights to state lands (0% listed for Santiago); and comodato, land lent out gratis (0% listed) .

Water Tenure and Use. Water user networks are generally implied in irrigated agriculture. The national water code of 1984 proclaims all water resources the property of the state and assigns the state sole legal responsibility for authorizing, supervising, and taxing the use of water. But in reality, the government appears to have only limited control, mainly over state-built waterworks. A variety of longstanding, privately created, "owned," and managed systems of smallscale irrigation exist.

Single-family irrigation systems are reportedly somewhat rare in Cape Verde. However, both individuals and informally organized groups of families may develop smallscale, gravity-fed springwater irrigation systems based on galerias and ditches. Likewise for shallow, hand-dug wells in valley bottoms from which water is lifted with small diesel pumps and distributed to nearby fields in earthen trenches or plastic pipes. The latter system typically serves a small group of kin and/or neighbor households who may include owners, renters, or sharecroppers of land. Reportedly, they devise their own schedule of water distribution and timing according to differences in crop mixes and land sizes among members; and they share out the purchase of the pump and its operation and maintenance costs proportionately. In both systems, water is distributed in turn to each family, with quantities being controlled by the duration of flow.

An innovative form of a multi-user water network was discovered during PP design discussions with farmers in Ribeira Seca. There, on their own initative, a group of 20 families of both kin and non-kin pooled a sum of 2000 escudos each to purchase plastic tubing from FAP (the national agricultural supply service) with which to convey water from government-constructed canals to their fields. Both renters and owners of land are included in this group of 20. The details of water

distribution using the tubing were unclear, but the tube is mobile; during the off-season, it is stored behind the house of a member family. Apparently, such strategies are not uncommon.

Another type of multi-user network (reported in Langworthy and Hillman 1989) relies on captation dams. These collect water from underground flows at or near the surface into holding tanks from which the water is distributed to fields via canals or plastic tubing by gravity. Details on the operation of this presumably government-instituted system are unclear. A third system consists of state-owned and -operated tubewells (furo) that distribute water over an area of 10 to 15 ha. Irrigation scheduling is established by the Junta dos Recursos Hidricos (JRH) via a local comissao de agua. A fee is charged according to cubic meters of water used per family. The JRH employs a local person to operate the pump and, along with the comissao, keep track of the fees incurred and see that they reach the JRH. In fact, however, users within the system develop strategies to trade or sell water rights amongst themselves and thus better adapt the JRH calendar to their individual needs.

Very little has been studied or written about how such innovations or informal modifications in water distribution are agreed upon and managed. Interestingly, however, the JHR has decided to create a pilot program that transfers greater responsibility for water management and cost-sharing to furo users themselves. INIA's Department of Social Sciences and Agricultural Economics (DCSEA) plans to study and compare this pilot effort to conventional JHR systems. This study should be complemented with further, in-depth qualitative investigation into traditional and privately-managed user networks, along with studies on land and tree tenure. All such information will be key to the success of WARD efforts to give users greater decision-making over, and responsibility for, water conservation and utilization systems (see "Sociocultural Feasibility").

Tree Tenure. Even less social scientific information exists for traditional range and forestry tenure in Cape Verde. Perhaps this is because, under Portuguese rule, both these resources were decimated... Since independence, the government has been carrying out massive afforestation programs on both private and public lands. Under current law, reportedly trees planted on private land -- whether by the owner, sharecropper, renter, or the state -- become the property of the owner. However, citizens of Cape Verde are legally forbidden to cut any tree without first obtaining permission from the Forestry Service. Theoretically, they must also obtain a permit before lopping for fuelwood (a maximum of 40% of the tree). However, it is not clear how well these regulations are understood, heeded, or enforced in rural areas, or even -- according to some of the design team's interviews -- whether government forestry and other officials themselves are clear on the regulations.

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Policy and practice concerning management and use of government-restored and/or open rangelands are even murkier. The only non-problematic area appears to be fruit trees, since these are never cut while they are still producing. Harvesting, too, is non-problematic. Land owners have rights to the fruit of trees on their land; in the case of sharecropping, the usual 50-50 split obtains. And in rental arrangements, disposition of the fruit is specified in the contract between owner and renter. Fruit trees reportedly are greatly prized and desired by agricultural families and appear to offer one, highly promising entree for WARD activities in agroforestry.

In 1989, a new Forestry Code was promulgated. But the mechanics of its implementation were never fully worked out during the PAICV's administration. According to various sources, the MPD plans to reexamine this code before moving ahead with its operationalization. For the moment, however, there is great uncertainty with regard to national forestry and range policy. No matter what code is finally settled on, the issues largely center on the relative roles of government, private enterprise, individual landowners, non-landowners, and communities in the management and use of forestry and forage resources. Ideally, this code will be made to mesh with the Water Code and especially the Livestock Code (elaborated in the late 1980s but still awaiting implementation detail), as well as with a presumably forthcoming Land Use Code (possibly the same as a Soils Code that the design team also heard of) that was mooted during the previous administration's flirtation with land reform but that has since been stalled.

Labor. The social organization of labor for cropping takes multiple forms. Household labor is universally preferred, followed by junta mao, a reciprocal exchange of labor among related and/or unrelated households, calculated on an equal exchange of persondays for the same task among the same sex and age. Junta mao is most commonly used during peak "crunches" in the cropping cycle -- planting, weeding, removing corn tassels, harvesting. Ajuda is generalized reciprocity, i.e. it is offered gratis with no expectation of return. It may take the form of assistance in agricultural work, small services, regular gifts of food, and so forth -- especially to the needy, elderly, or families in crisis. Widows in particular benefit from this custom. Pago or paid farm labor is rare and is typically used only by families practicing intensive, irrigated, and relatively largescale cashcropping.

With regard to biosocial roles in agriculture, women's work on rainfed farms accounts for 42% of total household labor, in contrast to men's 26% (Finan and Belknap 1984:16). Curiously, in families working mostly irrigated land, women reportedly contribute only 9% of farm labor (ibid.). Adolescents and elderly men often take charge of any herding duties; and various

family members cut, carry, and store forage and water the stock. Significantly, a whopping third to a half of total household labor is devoted to stockraising; for many rainfed farms, this is their most lucrative activity (Finan n.d.:23).

Other forms of cooperation or social organization relating to labor use in rural Santiago include chapters of the national women's and youth groups and the national maternal health and family planning program, consumer cooperatives that manage small stores, parents' associations and schools and school groups, and church memberships. Members of these and of other associations often organize into voluntary workgroups (campanhnas) to accomplish specific tasks such as construction and maintenance of schools, churches, community social centers, and homes.

Finally, although not a labor-related social structure, various kinds of local-level savings societies exist in rural Cape Verde. Known variously as Boto, Ritin, associacao funeraria, and other terms, they are primarily designed to cover anticipated funeral expenses. However, under the direction of the WDP's Rural Assistance Program or RAP (see later sections) working in conjunction with the National Cooperative Institute (INC), it appears that these societies have been profitably utilized as a metaphor for instituting bank-based savings systems in a number of watersheds. This program has given producers new skills in and understandings of personal financial management, and could help pave the way for modest agricultural credit schemes.

Beneficiary Profile: Producers of Santiago Island

An island-wide profile of agricultural families and their general agroecology is as follows (based on Finan and Belknap 1984, Langworthy and Wade 1989, and/or MDRP 1990). Working outward and down from the mountainous center of the island, Santiago displays roughly three to four ecozones, depending upon one's taxonomic system: humid, subhumid, and semiarid to arid. It is difficult to generalize about farming systems across these zones; variation depends as much upon the distinction between rainfed hillsides versus the relatively water-rich valley bottoms as upon altitude and mean annual precipitation (see Agronomic and Environmental Analyses). On Santiago, 20,728 ha of rainfed and 20,728 ha of irrigated land are cultivated. Generally speaking, dryland agriculture predominates in the humid zone and irrigated in the arid. Some mix of the two is the norm in other ecozones. But livestock are raised in all ecozones.

According to Finan and Belknap's 1984 (p. 7) survey of rural Santiago plus MDRP field data (Table 4.3.1), the average agricultural family on Santiago has 5.7 members and access to 1.3 ha of arable land. But only some 24% of families (MDRP 1990) have access to any irrigated land -- a mean parcel of 0.1 ha.

According to the 1984 survey, family livestock holdings average 1.1 cattle, 2.3 goats, 1.5 swine, plus a few poultry and occasionally a burro. However, there is great variation in all these averages. In particular, access to irrigated land makes for significant differences in key household socioeconomic factors such as numbers of species and mixes of crops raised, farm yields, family income, allocation of family labor, and gender roles in agriculture. For example, net revenues per unit of irrigated land are approximately 10 times those for rainfed land. Not surprisingly, water for irrigation is a commodity of great value in Cape Verde's Sudano-Sahelian environment. (See later section on equity.)

Income averages for rural Santiago alone are difficult to come by; but for the nation as a whole, average farm incomes have been estimated at U.S. $1,590 per household or $265 per capita (NA n.d.-a:5). Rural families derive income and/or foodstuffs from the following sources: remittances from emigrant relatives -- perhaps a third of rural households have members (almost always adult males) working abroad at any given time; crop and livestock production; sales of other products such as fuelwood, fodder, and crafts; government welfare payments in cash or kind for the elderly and children in impoverished families; and off-farm labor. In the vast majority of cases, off-farm labor consists of employment on public workfronts. Aproximately 60% of rural families rely upon these workfronts for much or virtually all of their annual cash earnings (see later sections).

While rural household structure generally follows a nuclear-family pattern, some 30% of households include an elderly relative; many others include offspring of unmarried children, godchildren, or other real or fictive kin. Three broad categories of rural households are identifiable on Santiago: those headed by single females, including widows; those headed by farm wives with emigrant husbands; and those headed jointly by husbands and wives. All together, about 40% of rural Santiago families are headed by women, roughly 66% of whom are single mothers who never married but are raising families.

Families headed by single mothers are significantly disadvantaged. They have little access to irrigated land, are less able to expand land resources through sharecropping, own fewer livestock, do not participate as fully in the market economy, and generally have lower educational levels than the other two types of households. The women look forward to the day their children can help with the farmwork; in the meantime, they rely heavily on welfare payments to "vulnerable groups" in order to survive from year to year. In 1984, for example, some 45% of single female farmers received government welfare, in comparison to 30% of joint households; also significant, family planning services were used more by the latter than the former. Particularly for rainfed farms on Santiago, Finan and Belknap

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(1984:49) conclude that, "In summary, the female-headed farm represents a serious social problem."

Finally, rural educational levels are low. Within Finan and Belknap's sample, 72% of household heads were illiterate. Moreover, nearly 20% of households had no members with any formal education. Everywhere, women's educational level is less than men's. These figures reflect national trends of low literacy rates despite the fact that some 90% of children ages 7-10 are enrolled in school (USAID 1988:2).

Beneficiaries

On Santiago Island, the Ribeira Seca watershed has been singled out as a target site for experimental, on-farm, and interdisciplinary applied R&D focusing on SWC and crop and livestock measures that producers themselves can institute, manage, and maintain in order to increase their agricultural yields and incomes. At the same time, on a diminishing scale across the LOP, WARD will continue to support DGCSAFER in SWC structures and plantation forestry on suitable sites, using CBWF wherever possible, but with an increasing emphasis on maintenance rather than construction. These activities will be carried out in Ribeira Seca plus 11 other watersheds on the windward side of Santiago: Tarrafal and Cuba at the extreme northwest of the island, and descending from north to south on the eastern coast, Principal, Sao Miguel, Flamengos, Saltos, Santa Cruz, Picos, Cumba, Mangue, and Sao Domingos.

Direct and indirect producer beneficiaries of the proposed project can be grouped into the categories listed below. A further group of direct beneficiaries consists of the researchers, extensionists, and rural outreach personnel who will participate in the project. Many of these will benefit through support for their RD&E activities and through professional training and advancement. This group is not discussed in detail here. (See "Sociocultural Feasibility" and "Impacts" below, however; and consult section on training for numbers and types of trainees. For environmental beneficiaries, see relevant analysis.)

- Men and women members of community-based workfronts
- RAP personnel
- Men and women producers within the target watershed
- Men and women producers of the other 11 project watersheds
- Rural and urban consumers

The total population of all 12 WARD watersheds is

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conservatively estimated at 45,000. A more precise figure is difficult to come by due to several factors. For one, population, agroeconomic, and etc. data are not broken down by watershed in Cape Verde. As in most countries, government statistics are reported by political rather than topographic divisions. The lowest level at which such data are disaggregated is the freguesia, somewhat akin to a county; yet even these small units may span two or more watersheds. Furthermore, where to draw the boundaries on a watershed itself is a fuzzy issue, especially along the valley ridges. The PP design team finally arrived at this 45,000 figure on the basis of intensive document review, consultation with both U.S. and Cape Verdean personnel with field experience in the zone, and careful study of both topographic and demographic data from recent (1998-1990) national censuses data and numerous rural development maps elaborated with French foreign assistance. Happily, more concrete counts for Ribeira Seca were obtained from the Conselho Sta. Cruz office of MDRP, thanks to the kind assistance of its Director, Mr. Carlos Monteiro (consult Table 4.3.1.). Nevertheless, at project start-up, a first task should be review and socioeconomic stratification of population data for, first, the target site and, second, for the precise numbers and proportions of equivalent groups in the other 11 watersheds.

Members of Community-Based Workfronts. These men and women constitute the most direct and immediate beneficiaries of WARD. Under a monetized PL480 food aid plan, earlier WDP-style SWC and forestry activities will continue in all 12 project watersheds. As before, recruitment will be locally administered to assure that work is offered first to the most needy families. Typically, only one member per family is allowed to work. For an excellent overview of the rationale behind such cash-for-work programs generally, and for insights into their context-specific application, organization, sometimes-necessary mitigations, and so forth, see Goldstein and Frankenberger n.d.

Across the LOP, project-supported workfronts will provide a programmed total of 97,000 personmonths of employment (see relevant sections of PP). Calculated according to the workfronts' 26-day month and reckoning a 10-month workyear, these figures yield 7,215 personyears. Across the 7-year LOP, this averages annual employment for 1000 individuals. Given that only one member of a family can normally be employed at a time, and reckoning an mean family size of 5.7 members (see Table 4.3.1 and "Other Observations" at conclusion of this analysis), this translates into direct benefits to an total of 5,700 rural Santiagans annually. At the present exchange rate of approximately 75 escudos to U.S. $1.00 and a mean payscale of 200 escudos per day (to account for inflation and GCVC pay raises), this equals salary benefits of U.S. $5 million across the LOP.

Under WARD, community-based workfronts (CBWFs) will be given

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preference in these tasks wherever possible. Workfronts in Cape Verde are of two types. The original type are termed "classical" workfronts (CWF). Briefly put, they are merely workgangs composed and directed by government agencies, with little or no concern as to whether workers directly benefit or learn from the development projects they labor on. The government hopes to do away with CWF and has taken pains to "reconvert" them to other organizational forms. Since 1986 (Gardiner 1988), on Santiago they have been replaced by CBWFs.

In contrast to CWFs, CBWFs are designed to be drawn from, and help build solidarity within, agricultural communities. They are composed of some 17 to 30 members, each from a different family. As envisioned under WDP, CBWF promote a modest form of local participation in that: crew leaders are elected by workers instead of being appointed by functionaries; workplan decisions and schedules are negotiated between the locals and the project or government agency; and the SWC structures that workers erect are supposed to benefit lands that CBWF members themselves utilize. In addition, CBWFs aim to develop human as well as biophysical resources by affording both female and male workers leadership roles, by instructing crews in procedures for democratic elections, and by providing training in, e.g. technical aspects of improved SWC practices, nursery management, and administrative procedures. (For much greater detail, consult Gardiner 1988.) Thus benefits from this component of the WARD project are geared to go beyond merely providing subsistence salaries to manual laborers.

Under the WDP, neither were CWBFs limited to working only on state-run SWC schemes in which they have no say. Community members had input into site selection for project SWC works. In addition, CWBFs enjoyed a self-help program in which they selected smaller, community-improvement projects such as: building canals, civic centers, or wells; promoting horticulture; and establishing joint community/project tree nurseries. The community then provided labor and the project, through RAP, contributed equipment and supervision (see Hodson et al. 1990:59 ff.) Thereafter, the community is supposed to take resonsibility for its "mini-projects." In large part (an estimated 70%, according to the former director of RAP), they have done so, at least insofar as investing all necessary labor for maintenance. Materials have been more problematic.

WARD will continue CBWFs, but on a diminishing scale across the LOP. CBWFs have not always achieved all the benefits they aspire to on paper (see Hodson et al. 1990, Annex L). And in the final analysis, they do not offer sustainable solutions to rural un- and underemployment. Under WARD, the menu of CBWF self-help projects will change somewhat as applied R&D identifies more readily sustainable, income-generating activities in agrosylvopastoralism that in the long term can help free

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producers from reliance on workfronts for critical income.

RAP Personnel. Under WARD, CBWFs will continue to be trained and supported with the help of RAP. This para-extensionist corps was created within DGCSAFER and utilized by WDP to meet the project's needs for rural outreach agents at a time when the formal extension service was only just being organized on paper (see "Issues"). As shown in Table 4.3.2, between 1987 and 1990, RAP organized 31 CBWFs in all but 3 of the WARD watersheds (Cuba, Mangue, and Sao Domingos, at the extreme north and south of the project area, respectively) with a total membership of 1,038 as of 1991. RAP field agents are all active producers selected from the local communities in which the project works. Under WDP, these 12 men and 9 women (Table 4.3.3) received considerable training in extension subjects (Table 4.3.4) at INIA's Training Center. Under WARD, selected RAP agents will be afforded additional, more advanced training. Thus RAP agents represent yet another subgroup of producer-level beneficiaries of WARD.

Producers in the Target Watershed. In folding the former FCRP into the proposed, combined project, WARD RD&E activities will benefit inhabitants of the target watershed in both the medium- and longterm. In both rainfed and especially irrigated zones of Ribeira Seca, applied SWC research and on-farm production-systems research will be oriented toward increasing agricultural yields and increasing or at least stabilizing producers' incomes as workfront employment decreases, while at the same time improving the natural resource base so that these gains can be sustained. Technologies and practices generated and/or extended under WARD aegis -- either solely or, in the case of rainfed production, in collaboration with the IFAD project -- are designed to directly or indirectly benefit the majority of inhabitants of Ribeira Seca. Currently, watershed residents number 12,248, comprising some 2,150 families if calculated at 5.7 members each. By EOP, these figures are projected to be 13,875 and 2,434 respectively (Table 4.3.1).

From the producer's perspective, tangible benefits deriving directly from SWC measures and agrosylvopastoral initiatives may include (but not be limited to): increased diversity within farming systems and thus decreased risk; increases in farm yields of, e.g. staple foodstuffs, vegetables, meat, dairy items, fruit, fuelwood, forage, fodder; better balance in family diets; augmented, scabilized, and/or more independent household income flows resulting from increased sales of and/or decreased expenditures on purchases of such products; improvements in household dietary patterns and food security; and possibly further earnings from rural microenterprises stimulated by project activities (e.g. seedling sales, cheese-making).

Producers may also benefit directly or indirectly,

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individually and or jointly in other ways, for example, from self-help works undertaken with project assistance. Additional secondary or intangible benefits can also be expected, although these cannot be specified with confidence. Hence the need for a comprehensive PLI monitoring program (see relevant section). These more subjective benefits might include a sense of, e.g.: increased self-determination, choice, and control; relatedly, expanded SWC and agrosylvopastoral acumen; improved quality of homelife due to lessened need for fathers to emigrate or for children to work in order to secure family survival; greater community cohesion and initative, as reflected in such things as establishment of a community chest, new interhousehold or community organizations or forms of cooperation, or new memberships in such organizations; improved communication and mutual appreciation between government research and extension services; individual or community ability to sustain gains made under the project; and still more.

Producers in the Other 11 WARD Watersheds. Technical and socio-organizational results from WARD experimentation and demonstration work in Ribeira Seca should be readily transferrable to the majority of the other watersheds on the same, windward side of Santiago. FCRP research has indicated very little overall variation in present farming techniques island-wide (although there are of course identifiably distinct farming subsystems), and there is no evidence of major ecozonal variation. The only potential, partial exception to technology transfer "as is" are the two most northerly watersheds. Reportedly, they exhibit slightly different ecological parameters; sociological differences, however, are reportedly insignificant.

Hence, with clear specification of recommendation domains, most of the same benefits in SWC structures and measures and in crop, livestock, and agroforestry techniques described above for the target watershed should be applicable to the equivalent groups in the other 11 watersheds. Moreover, interventions in these other zones should pose less farming or stockraising risk, since they will already have been tested and evaluated in the target watershed.

Significant transfer is functionally feasible given that RAP personnel and/or DGER extensionists are already in place in all but 3 of these watersheds and will remain active there throughout the LOP. Assuming that RAP or DGER extensionists are eventually assigned to cover these three and that population across the 11 watersheds is approximately 32,750 (45,000 minus Ribeira Seca's 12,250), then some 5,750 families (calculated at 5.7 members) could potentially benefit, either directly or indirectly, from WARD accomplishments (see "Impacts").

Producers in Other Watersheds on Santiago or Other Islands.

WARD technologies and land-use practices will likely be readily transferable to many other watersheds of Santiago. According to Finan and Belknap (1984), the island is broadly uniform in its socioeconomic complexion; and variances in ecological phenomena across watersheds are known to pattern in somewhat predictable ways. This is particularly true of the other 11 watersheds, which have received considerable development attention from WDP and third-country donors. A possible caveat in this assessment is the leeward side of Santiago, which has been less studied and which displays a significantly different rainfall regime. It is even more difficult to predict the immediate applicability of WARD outcomes to other islands of Cape Verde, in that "The interisland socio-economic and agricultural differences are so great that the patterns discerned on Santiago cannot be generalized to the country as a whole" (Finan and Belknap 1984:11). However, at least some of the practices and most of the principles are likely to be transferrable.

Thus, except in cases of relatively close ecological and sociological similarity to the 11 watersheds of project activity, it cannot be assumed that WARD technologies and agricultural practices will transfer "as is" to producers everywhere in Cape Verde. Instead, impacts will largely accrue indirectly and across the longterm (see "Impact" below).

Consumers. Consumers of agricultural products constitute a final, indirect group of WARD beneficiaries. They stand to benefit both economically and nutritionally. Horticutural crops and livestock products are extremely important to Cape Verdean consumers, rural and urban alike. Prior to independence, virtually all vegetables were imported. Today, the country meets most of the demand for vegetables among middle- to upper-class urbanites; but during most of the year, average urban consumers and the rural poor find produce prices prohibitive (University of Arizona n.d.). Similarly for dairy products and possibly some fruits. To the extent that project-designed crop and livestock technologies and practices succeed in reducing production costs and/or raising yields (and of course, to the extent that extension is successful in disseminating project innovations), the cheaper food prices that typically result will tend to benefit lower-class and poor consumers. In addition, new crop varieties and species may place a greater range of healthful products on both rural and urban markets. Moreover, improved agrosylvopastoral techniques may remove some of the seasonal constraints on the availability of nutritious foodstuffs, assuring a steadier supply of horticultural and livestock products yearround.

PARTICIPATION

The participation of representatives of all beneficiary

institutions to be involved in WARD was systematically sought during both PID and PP development (see list of persons contacted by PP team). Their input was both welcome and useful, and it informs virtually every element of the PP. Members of these institutions will be key participants throughout the LOP -- in implementation, evaluation, flexible redesign of project directions as needed, and supervision via a Coordinating Council (see Institutional Analysis).

There was little direct participation by producers in either PID or PP development, aside from a few brief field interviews with handfuls of producers by one member of the design team. However, project design builds upon farmer participation in one sense, in that it draws upon survey data collected among producers themselves during the course of the FCRP and other-donor efforts. Early in project start-up and as part of collection and synthesis of baseline socioeconomic data in the target watershed, WARD will systematically canvass producer opinions and attitudes pertaining to both general and specific R&D activities proposed under WARD. This information will then be used to refine and prioritize activities. Such canvassing of opinion and insight will be included as a vital and on-going part of WARD. It is critical for getting farmer feedback to both research and extension so as to keep R&D activities "on course" in terms of producers' -- as versus projects' -- priorities, needs, and constraints.

The on-farm and in-field emphasis of WARD offers one of the primary arenas for producer participation and decision-making in conjunction with research and extension. Both RAP and INIA's DCSEA, along with DGER, should take special care to see that producer perspectives and priorities are clearly communicated to research and other project components in a systematic and promptly "useable" fashion. Indeed, one of the principal lines of current work within DCSEA is a program on farmer-INIA linkages. DCSEA (n.d.:unpaginated) plans to take the initative in forming interdisciplinary teams of INIA researchers to visit participating producers, so that "...the team will develop...on-farm research trials with the full collaboration of...farmers in the research design" of, e.g., improved crop and forage variety tests, irrigation management and water-use efficiency trials. RAP representatives, in particular, can be instrumental in the participation and communication process in that they are natives to and resident in the watersheds to be impacted.

Moreover, particularly in the target watershed and in collaboration with the upcoming IFAD project, WARD will experiment with helping producers to adapt or broaden existing kinds of community-level or group organization that may facilitate their more efficient use of or access to, e.g., new agricultural information, basic factors of production, or agricultural credit. Finally, another form of participation is

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ensured through the training opportunities WARD will extend to researchers, DGCSAFER technicans, DGER extensionists, RAP personnel, and above all, producers themselves (see Training).

SOCIOCULTURAL FEASIBILITY

Producers

In the background data on project beneficiaries, a healthy number of existing socio-organizational structures for cooperation, self-help, and producer control over productive resources were identified within agrarian communities of Cape Verde. These bode well for WARD efforts at stimulating smallscale community- or inter-household-based SWC measures and more productive and sustainable cropping, stockraising, and agroforestry systems at the family level -- systems that may ultimately free agricultural families from dependence upon government workfare and donor assistance. To the extent that the project builds upon both the reality and the metaphor of these "human structures," and to the extent that it encourages real as versus token participation and decision-making on the part of producers, to that extent, too, it is socioculturally feasible.

The importance of producer participation and decision-making cannot be over-emphasized. An expensive lesson has been learned from WDP and still earlier experiences with government-sited, -directed, and -financed SWC structures. To wit, people who have had no part in decisions about the locale, scale, need, benefit flows, and subsequent responsibility for such undertakings understandably feel no responsibility for their maintenance and repair.

An anecdote from interviews with producers in one community is illustrative. There, an elaborate windmill-based well complex was constructed, including: a rank of taps for drawing drinking water; connecting piping to fill a phalanx of concrete laundry tubs; a housing with a lockable door to keep animals, children, trash, and other objects from falling into the well; and an irrigation system for an adjoining nursery. Within a few short years after construction, however, the taps failed. Today, 6 years later, people once again draw water by hand using ropes and filthy containers; all manner of extraneous matter can be seen floating in the well; and the previously potable water is now unfit to drink without boiling or bleaching. The community has made numerous entreaties to the relevant government agency to repair the structure. But when queried why they did not raise the money to repair the taps themselves, locals replied in effect that "The government built it, so it is the government's job to maintain it." Put another way, the structure is everybody's and nobody's. Local people had no say in its construction, siting, etc.; nor were they offered any training in its upkeep; and no

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agreements were sought with the community beforehand as to its assistance in repair and maintenance of the complex.

The lesson in such tales should be clear. Certainly in the target site, experimental SWC measures and on-farm trials and interventions should be based on an informed agreement between WARD personnel/agencies and participant volunteers or local producer groups. In other developing countries, elaboration of a simple written contract has worked well. Such contracts have been based on various forms of risk-sharing and negotiation over R&D priorities between people and projects. It would be helpful if the consortium selected to implement WARD were to have experience in such arrangements.

Issues of land, water, and tree tenure naturally arise in a project that plans to involve producers in longterm, largescale, costly, risky, or permanent investments such as SWC measures or new cropping and range practices. Interestingly, however, the handful of farmers (approximately 10 women and 4 men) informally interviewed during PP design expressed little concern about the stability of their sharecropping or rental arrangements, noting that these are traditionally passed down from father to son indefinitely. Other informants indicated that there are often strong emotional, fictive-kin, and community ties between landowners and their tenants or renters such that the latter are not lightly dismissed.

This anecdotal information is encouraging in terms of WARD objectives. Still, much remains to be learned about the form and functioning of the human structures discussed above in relation to tenurial regimes. Thus, immediately upon project start-up, producer attitudes toward present systems of land, water, and tree tenure regimes must be systematically investigated, especially as these pertain to proposed project activities. In view of recent efforts at agrarian reform (now suspended pending review by the new government), this study will be especially useful for assessing producers' current understandings or fears concerning government land policies. The work of WARD biological, technical, and socioeconomic researchers and developers -- expatriate and national alike -- will be successful insofar as they gain a clear picture of both "real" and "ideal" tenurial systems in rural Cape Verde. Such a study will provide a critical corpus of baseline information for designing project R&D thrusts in a way that is in fact socioculturally "do-able."

Research and Extension

An important WARD task will be introducing the Cape Verdean research and extension community to concepts and approaches in interdisciplinary collaboration and participatory on-farm RD&E. INIA researchers are frank in noting their inexperience in these regards. There is therefore a risk that researchers might merely

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continue the same work they would normally do on-station at a different site, with little meaningful interaction and honest exchange of ideas with producers. Regarding extension, design-team interviews suggested that DGER in large part views its job as one of "convincing," "persuading," and "changing farmers' mentality" -- although often it is the "mentality" of researchers and extensionists that most needs changing...

Such issues of sociocultural feasibilty in fostering the kind of interactive and participatory development paradigm that WARD espouses will be addressed in several ways. First, the TA implementation team will be experienced in participatory on-farm RD&E. Thus they can help model and guide such approaches. Second, the project will early on provide in-country training sessions on principles, methods, and case examples of on-farm research and farmer participation for both reserachers and extensionists. These sessions will be limited to individuals from entities that will actively participate in WARD (e.g. Consortium personnel, INIA, DGCSAFER, DGER, RAP, representatives of the IFAD project). The curriculum will ideally include fieldtrips to model interactions with agricultural families; in-class producer panels from the target watershed; initial design of interdisciplinary R&D protocols and baseline studies necessary to successful project implementation; and so forth. Among other things, this training strategy will begin the lengthy but all-important process of interdisciplinary and inter-institutional team building.

To ensure that on-farm RD&E is feasible, the project also needs to address the current shortage of field-level personnel (data gatherers, para-extensionists, extensionists) that are necessary to build and maintain links between producers and researchers -- especially when the latter are subject to the tug of many different projects and donors. Solutions to this shortage will be sought along several fronts, e.g. coordination with IFAD project members, multiple uses of DGER and RAP personnel as data gatherers as well as community animators, recruitment of additional field personnel (especially women) as needed for these increased responsibilities, inclusion of model-farmer cooperators, and assignment of Peace Corps members to community-level and on-farm activities of WARD.

IMPACT

Equity

WARD will conscientiously address equity issues identified for the following beneficiary groups: women-headed agricultural families, producers on rainfed lands, producers in the upper reaches of watersheds, and sharecroppers and renters as versus landowners. As noted earlier, WARD will seek ways for the

project to share some of the risk of experimental on-farm research, at least initially. This need is most relevant to the groups discussed here.

Women-headed Households. Recall from the beneficiary profile that women head 40% of all rural households on Santiago. The size of this potential beneficiary group means they cannot be ignored. Recall, too, that a majority of female-headed families are significantly disadvantaged in terms of access to land, labor, water, markets, and education. Indeed, Finan and Belknap (1984) question whether such families can be agriculturally viable. Taken together, these factors mean that WARD faces an extra challenge in tailoring workable farm-level interventions to fit the tight constraints of this large group. Two avenues will be examined in this regard. First are low-labor-input and/or high-return activities that can be accomplished through labor-sharing arrangements. Such interventions do not always require increased direct access to land; examples are fruticulture and smallstock rearing in confinement. Second, embedding or organizing such families in larger cooperative or associational units can sometimes help secure them greater access to the factors of production. However, a special study of such families' farming situation may be necessary to identify promising strategies for experimentation or, alternatively, mitigating activities.

Producers on Rainfed Lands. In its plan to pay relatively more attention to irrigated as versus rainfed agriculture, WARD runs the risk of "short-changing" the vast majority of Cape Verdean farmers -- those who work only rainfed land. Recall that this group accounts for 76% of all producers in Santiago (again, many of them female-headed families); and 96% of all croplands on the island are rainfed (20,728 out of 21,652 ha).

To address these statistics, among other things, WARD will emphasize that new irrigated land be made available to families who do not have access to this invaluable resource, as versus merely extending the holdings of producers who already do. Under the guidance of project social scientists, negotiations and contracts among all concerned -- landowner, renter/sharecropper, community- or inter-household group involved; the project; and if necessary, the relevant court or land office -- must be drawn up before construction of waterworks is begun. Otherwise, socioeconomic stratification will be exacerbated and community tensions will arise. Reportedly, these can reach violent levels, according to tales of fights over water rights even among fathers and sons.

The project will also take advantage of a complementary strategy to address the predominance of dryland farmers. Since nearly all (93%) people who work irrigated land also do rainfed agriculture, on-farm collaborative trials can easily address both

regimes at many of the same sites. Although socioeconomic recommendation domains will be quite different between rainfed farmers with and without access to irrigated land, some of the resulting technology should be transferable with modifications. Finally, WARD will need to coordinate closely with the Ribeira Seca IFAD project, which is focusing exclusively on rainfed agriculture. Along with the DGER, RAP can be instrumental in extending or refining findings from IFAD, and vice versa, for improving rainfed, as well as irrigated, yields and incomes.

Producers in the Upper Reaches of Watersheds. Concerns have been raised that relatively little was done under the earlier WDP to benefit producers in the upper reaches of watersheds. To be technically effective and stable, watershed work ideally needs to begin at the top and work its way down (Egli n.d.). Otherwise, structures and farming systems downstream may be destroyed or eroded. By the same token, however, downstream producers tend to reap the bulk of benefits of watershed improvements. To address this potential inequity and in accord with its integrated approach to watershed management, in collaboration with DGCSAFER and IFAD, WARD will take care to include technically feasible and appropriate SWC actions in the upper reaches, such as spring development and sylvopastoral improvements. These can be implemented under self-help as well as workfront programs.

Sharecroppers and Renters. WARD will endeavor to ensure that benefits redound to the people who invest their labor and learning time to collaborate in project activities -- i.e., producers themselves. Particular care will be taken to establish beforehand that disproportionate benefits from project activities will not merely transfer from renters and sharecroppers to landowners. For example, if land values are increased tenfold due to project-inspired waterworks, sharecroppers or renters might run the risk of being dismissed from their plots or having their rents prohibitively raised by landowners eager to garner all or much of the profits of newly irrigated lands for themselves.

To forestall such problems, at project start-up WARD will conduct or contract a study of both "real" and "ideal" land, water, and tree tenure, as described in earlier sections. This will facilitate prediction of "who wins and who loses" under different scenarios of choice, siting, level, and etc. of activities. I.e., what benefit flows and negative impacts can be expected to whom under what conditions? And, how can the flows be more tightly targeted and the negative impacts mitigated? (In the process, this study will likely provide additional insights into the equity concerns noted above.) Findings from this study will inform project workplans. In addition, non-landowners themselves will be consulted as the ultimate "experts" on how best to protect or advance their interests. As noted above, appropriate contractual steps should be taken ahead of time among

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all parties concerned and the project. These steps and the implementation strategies deriving from them will "ward" against inequitable development and exacerbated socioeconomic stratification.

Spread and Sustainability

Briefly, broad and/or longterm impacts from WARD can be expected in quite a number of ways. First, the expenditure of some U.S. $5 million on public workfronts constitutes a significant stimulus to both the local- and island-level economies across the LOP. In the longer term, as workfronts are phased down and as proven, ecologically sustainable, income-generating SWC/agricultural technologies and practices tested by WARD are extended, the national economy will ultimately benefit from reduced workfare and welfare roles, increased and more diversified agricultural production, foreign exchange savings from import substitution of more for less costly foodstuffs, and possibly reduced rural-to-urban population shifts.

Over the long term, country-wide impacts should also result from: the overall strengthening of human resources in applied natural resource management and agricultural R&D; improved coordination and understanding among the agencies responsible for RD&E in these arenas; and gains in crop varieties and farming strategies of potential use throughout Cape Verde. Assuming institutional sustainability over the long term (see relevant analysis), Cape Verdean scientists and their agencies should be able to adapt WARD accomplishments to other watersheds of the nation. Similarly, technology transfer of these modifications should be enhanced over the longterm through WARD's modeling of more interactive and egalitarian research-extension-farmer linkages.

Certainly, the social and economic value of restoring and sustaining a nation's land, water, and forestry resources for both present and future generations is inestimable. It is here that WARD will make one of its paramount contributions. In addition, WARD's increased emphasis on local participation in the design, implementation, and maintenance of improved conservation and agricultural strategies should stand as a model for future development efforts within Cape Verde. While it is difficult to place a monetary value upon the less tangible social, economic, and political benefits of more democratic forms of development, this could be WARD's greatest impact. Especially exciting is the opportunity to pilot new forms of democratic choice and responsibility in protecting a national patrimony. Findings from WARD could be of direct use in informing policymakers as they move torward what in effect is a plan for integrated natural resource law in Cape Verde.

ISSUES

Most of the issues that WARD will need to address in terms of social soundness have been built into earlier sections above. Here only two major concerns are noted, along with some additional observations that may prove useful in project start-up and implementation.

The Institutional Home and Roles of RAP

As the only established on-the-ground contact point with the people to be served under WARD, RAP is critical to project success. Yet thorny issues as to its most appropriate and viable insitutional home and range of roles (CBWF labor recruitment versus other, more community-development-focused activities) have been raised. These issues have been very thoroughly and competently explored in Gardiner 19?? and Hodson et al. 1990:62, and require no additional analysis here. Drawing upon these earlier analysis and working through its inter-institutional Coordinating Council, WARD will need to resolve RAP, and related CBWF issues, as soon as feasible after project start-up and in a manner satisfactory to all concerned.

The seemingly most workable solution so far suggested is an at least partial folding of this USAID-created, para-extensionist organization into the formal, DGER system. Under this scenario, in the relatively short term represented by WARD, outstanding RAP field and coordinator personnel would be selected for advanced training with an eye to their eventual incorportion into DGER if their performance is satisfactory. Other RAP personnel -- especially local-level producers in Ribeira Seca -- would seem ideal candidates for contact-, collaborator-, model-, what-have-you farmers in on-farm R&D. Indeed, a number of them already have experience in this role (Table 4.3.3). In the much longer term, as DGER gains strength and resources, it might consider instituting a category of field agents, into which such RAP personnel might fit. Such decisions, however, are not WARD's alone.

PLI Monitoring and Evaluation

In addition to systematic tracking of biophysical impacts, WARD will mount a project-wide system for on-going monitoring of people-level impacts across the LOP. This will follow upon completion of start-up tasks such as compiling and synthesizing existing data and literature on the project area as a whole, conducting parsimonious baseline studies of the target watershed, and identifying potential "key farmers" and controls. The longterm TA in socioeconomics will be responsible for designing and establishing the PLI monitoring system (see relevant job description). Monitoring data will include parsimonious producer opinion studies as well as the more usual tracking of

yields, income, etc. This information will permit WARD to make needed course corrections in a timely and cost-effective fashion. PLI impacts monitored should include but not be limited to the direct and indirect, anticipated and unanticipated, tangible and intangible benefits -- whether to individuals, families, interhousehold groups, or communities -- discussed in the earlier section on beneficiaries of the target watershed.

Other Observations

NEED TO CHECK ON CURRENT SUPPORT AND HOLDINGS BEFORE DECIDING TO INCLUDE THE FOLLOWING.

If other donor assistance does not exist, modest support for the INIA library should be considered as a mechanism for ensuring institutional memory and forestalling costly and embarrassing re-inventions of the wheel with regard to both past and future SWC and agricultural R&D in Cape Verde. At present, documentation critical to the sucessful start-up of WARD is highly fragmented and, if it can be found at all, requires an exhausting search of myriad agencies and personal libraries. Making this information available in a single locale would greatly facilitate the work of all WARD personnel. The library would also serve as a resource for the INIA Training Center. Furthermore, this move would consolidate USAID/CV investments under the earlier FCRP in a library which, according to one report, may be the best of its kind in West Africa (comment by a representative of the United Nation's'AGRES Library Network, cited in University of Arizona/USAID n.d.).

In a related vein, at the time of PP design, only the global data from the most recent national agricultural census (MDRP 1990) had reached print.[1] Thus, much of the data in this analysis are drawn from earlier sources. An early ground-laying task of WARD should be to review and evaluate the full census (especially Volume 2's socioeconomic data) and correct any unwarranted assumptions in the PP in light of unexpected new findings. In addition, Phase II results from FCRP socioeconomic data should be reviewed. Based on a year's tracking of 40 carefully chosen agricultural families, this study categorized Santiago farming systems into 12 representative types, depending upon: amount of rainfed and irrigated land, crop rotations, total resource patterns, and economic returns. This and related datasets could prove of immediate use in project planning and in early efforts to forecast the social soundness of specific project activities for different recommendation domains. It will also be valuable in designing an efficient but effective PLI monitoring system.

NOTES

1 "Agricultural families" are defined in this document as "economic unit[s] of agricultural production subject to a unitary authority and comprised of all cultivated parcels, independently of the title possessed, juridical status, or size" (MDRP 1990:23, translation mine). The census thus is limited to families who raise plant crops. It excludes rural households that depend upon only stockraising, commerce, fishing, crafting, or salaried labor. Readers should also note that, for Santiago Island, only 50% of "agricultural families" were sampled in this census. Its findings do not always square with other datasets that may have been more carefully done and/or reached more remote parts of the island. Notable discrepancies include, among other things, family size and livestock holdings. For these parameters, PP design relies instead on figures from the MDRP's Santa Cruz field office and the Finan and Belknap 1984 survey.

ATTACH THE FOLLOWING

Table 4.3.1
1988 Population of Ribeira Seca and Projections to EOP

Table 4.3.2
Community-Based Workfronts Organized by RAP, 1987-1991

Table 4.3.3
Detail of RAP Personnel

Table 4.3.4
RAP Personnel Training under WDP

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TABLE D.4.1
1988 POPULATION OF RIBEIRA SECA AND PROJECTIONS TO EOP

COMMUNITY	NUMBER FAMILIES	NUMBER MEN	NUMBER WOMEN	TOTAL	AVERAGE FAMILY SIZE	RATIO WOMEN/ MEN
Montanha e Montaninha	176	440	525	965	5.48	0.54
Pico Antonia	128	483	405	893	6.98	0.45
Levada	35	75	82	157	4.49	0.52
Achada Costa	28	95	108	203	7.25	0.53
Boca Larga Acima	47	111	129	240	5.11	0.54
Fundura	58	157	230	387	6.67	0.59
Boca Larga Abaixo	61	145	175	320	5.25	0.55
Orgaos Pequenos	70	233	327	560	8.00	0.58
Poilao Cabral	87	209	277	486	5.59	0.57
Ribeirao Galinha	93	215	287	502	5.40	0.57
Pedra Janela,Joao Guela	44	133	174	307	6.98	0.57
Covoada	58	180	188	368	6.34	0.51
Cha de Vaca	31	68	83	151	4.87	0.55
Varzea da Igr. Serrado	31	71	70	141	4.55	0.50
Funco Marques	30	85	92	177	5.90	0.52
Funco Bandeira	28	84	79	163	5.82	0.48
Mato Raia,Lagedo,Carreira	68	291	213	504	7.41	0.42
Joao Teves,Covao Sequeiro	46	147	172	319	6.93	0.54
Joao Goto	50	87	125	212	4.24	0.59
Lage	65	182	176	358	5.51	0.49
Ped.Amolar,Varz. Santana	77	188	232	420	5.45	0.55
Longueira	75	202	214	416	5.55	0.51
S. Cristovao	79	205	234	439	5.56	0.53
Caiumbra	32	75	84	159	4.97	0.53
Ribeira Seca	93	221	287	508	5.46	0.56
Achada Fazenda	273	573	654	1227	4.49	0.53
Julanque	16	43	46	89	5.56	0.52
Librao	81	208	227	435	5.37	0.52
Ribeirao Almaco	31	72	93	165	5.32	0.56
TOTAL - 1988	1991	5283	5988	11271	5.66	0.53
PROJECTION - 1992		5741	6507	12248		
PROJECTION - 1998		6503	7371	13875		
Population growth rate for projections			0.021			

Footnote: Population projections calculated using the annual average growth rate for Concelho Sta. Cruz from 1980 to 1988.
Source: Reparticao Concelhia do MDRP/Sta. Cruz (courtesy of Mr. Carlos Monteiro, Division Head).

D.4.2

FRENTES RECONVERTIDAS

RIBEIRAS	Nº. DE FRENTES 1987	1988	1989	1990	Nº.DE TRABALHADORES 1987	1988	1989	1990	1991
TARRAFAL	0	0	1	1	0	0	50	50	
PRINCIPAL	0	0	0	1	0	0	0	30	
SÃO MIGUEL	5	6	9	8	85	160	268	293	
FLAMENGOS	1	1	2	3	24	24	74	104	
SALTOS	0	1	2	2	0	17	45	55	
SANTA CRUZ	3	4	6	6	78	117	177	177	
PICOS MON.	1	2	2	2	30	53	53	53	
PICOS JUS.	3	4	6	4	80	93	120	120	
SECA MON.	0	0	0	1	0	0	0	30	
SECA JUS.	0	1	2	2	0	26	56	56	
CUMBA	1	1	1	1	30	36	50	47	
TOTAL	14	20	31	31	327	526	893	1015	1058

D.4.3

AGENTES DE CAMPO

PROGRAMA ASSISTÊNCIA RURAL

P.R

NOME	SEXO	IDADE	ANOS DE ESCOLARIDADE	BACIA HIDROGRAFIC.	PROPRIEDADE		AGRICULTOR MODELO	OBS.:
					Seguro	Rendeiro		
Humberto Batalha Lopes	M	29 a.	8º.ANO	Flamengos	Sim	Sim	Sim	
Francisco Ramos Furtado	M	34 a.	6º.ANO	Baltar	Sim	Sim	Não	
João Tavares Menezes	M	37 a.	4º.ANO	Picos	Sim	Sim	Não	
Carlos Alberto Tavares Ribeiro	M	31 a.	4º.ANO	São Miguel	Sim	Sim	Não	
José Carlos Bento	M	24 a.	6º.ANO	S.Francisco	Sim	Sim	Não	
João Tavares Semedo	M	25 a.	6º.ANO	Cumbe	Sim	Não	Não	
Jeremias Moreno Semedo	M	28 a.	4º.ANO	Seca	Sim	Sim	Não	
Ernestina Lopes da Veiga	F	28 a.	8º.ANO	Seca	Sim	Não	Não	
Jacinta Vaz Landim	F	26 a.	8º.ANO	Picos	Sim	Não	Não	
Domingos Leal Ribeiro	M	27 a.	9º.ANO	Picos	Sim	Sim	Não	
Gregória Tavares Semedo	F	30 a.	4º.ANO	Picos	Sim	Não	Não	
Carlos Gomes Sanches	M	26 a.	6º.ANO	Picos	Sim	Não	Não	
Idalina Pina Mendonça	F	30 a.	6º.ANO	S.Cruz	Sim	Não	Não	
Arlindo Teixeira de Pina	M	24 a.	6º.ANO	S.Cruz	Sim	Não	Não	
Maria Paula Furtado	F	26 a.	6º.ANO	Baltar	Sim	Sim	Sim	
Manuel Garcia Fernandes	M	26 a.	9º.ANO	Flamengos	Sim	Sim	Sim	
Belmira Lopes da Veiga	F	29 a.	9º.ANO	Flamengos	Sim	Não	Não	
Marcisa Lopes Gomes	F	27 a.	6º.ANO	São Miguel	Sim	Sim	Não	
Justino Gomes Tavares	M	24 a.	6º.ANO	Flamengos	Sim	Sim	Não	
Maria Gracinda Tavares	F	22 a.	6º.ANO	Principal	Sim	Sim	Não	
Maria Filomena Balanteiro	F	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

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D. 4. 4

CURSOS MINISTRADOS AOS AGENTES DE CAMPO

PROGRAMA DE AGRICULTURA RURAL

P A R

C U R S O	D A T A	O R I E N T A D O P O R
TECNICAS ELEMENTARES DE CRIAÇÃO DE ANIMAIS DE PEQUENO PORTE	12/11 a 7/12/94 e 31/1/95 a 9/4/95	TECNICOS NACIONAIS
CONSERVAÇÃO DE SOLOS E ÁGUA E AGRICULTURA GERAL	2 a 14/6/96	TECNICOS NACIONAIS E INTERNACIONAIS
CURSO BÁSICO DE SAÚDE, NUTRIÇÃO E HIGIENE	15/9/96 a 4/10/96	TECNICOS NACIONAIS E INTERNACIONAIS
CURSO BÁSICO DE IRRIGAÇÃO	23/1/97 a 5/2/97	TECNICOS NACIONAIS E INTERNACIONAIS
TECNICAS DE COMUNICAÇÃO E DE CAPACITAÇÃO DO MEIO RURAL	26/9/93 a 1/10/93	TECNICOS NACIONAIS E INTERNACIONAIS

ANNEX D.5 INSTITUTIONAL ANALYSIS

OVERVIEW

The WARD project will be executed by a consortium of a US Title XII institution and a Private Voluntary Organization, hereafter known as The PVO. The PVO will be administratively responsible to the USAID project officer through his project manager. and will receive technical guidance through an Administrative Council headed by the Minister of Rural Development and Fisheries (MDRP) or his designee.

The WARD Coordinating Council will consist of the USAID project officer or project manager, the Chief of Party for the PVO, the Director General of Rural Extension (DGER), the Director General of Soil and Water Conservation and Rural Engineering (DGCSAFER) and the President of the National Institute for Agricultural Research (INIA). See Figure D.5.1.

The composition of the Coordinating Council will change under the reorganization of the new government. Although details of the reorganization have not yet been decided, it is expected that most of Rural Extension and INIA will be absorbed by the National Institute of Rural Development. DGCSAFER will become the core of the National Institute of Rural Engineering. See Figures D.5.3 and B.4.3.

Figure B.4.4 shows the current institutional organization of the Ministry of Rural Development and Fisheries (MDRP). Figure B.4.5 shows its most likely future organization based on information available at the time of project design. The MDRP Minister feels that by organizing activities into semi-autonomous institutes, Cape Verde will be able to reduce public expenditures and increase the efficiency of agricultural services. Theoretically, the institutes will be able to operate on a more business-like basis by contracting services to the government itself, to the private sector and to other projects; eventually it will be financially independent.The institutes should also improve their efficiency as they are not bound by government salary scales, labor laws and red tape. Figure B.4.3 shows the composition of the new institutes and how existing agencies are expected to fit into the new pattern.

ASSESSMENT OF CAPABILITIES

Government of Cape Verde

The final evaluation of FCRP and WDP (Experience, Inc., March, 1990, p. 13) concluded that, in general, GOCV demonstrated good capability in managing the WARD predecessor projects, especially in managing PL 480 commodities. However, the Evaluation found

deficiencies in inter-institutional coordination and cooperation, particularly in two areas critical to the new WARD project. First, INIA did not provided adequate research support to watershed development or to the extension service (which was not yet sufficiently developed to utilize it). Second, groundwater and irrigation development suffer because of lack of coordination between the Water Resources Board (JRH) and DGCSAFER. The evaluation recommended that "At the outset of the new project, cooperative agreements with other Cape Verdean agencies should be arranged, with clear definition of cooperative interaction. Activities that are outside the natural scope of watershed development should be assigned to other organizations." (p. 63)

The WARD Coordinating Council should provide a forum for correcting inter-institutional deficiencies, but USAID should insist on certain conditions in the Cooperative Agreement.

- GOCV will continue all necessary support (particularly salaries) to agricultural research, conservation, extension and other WARD activities after reorganization

- GOCV will guarantee the continued participation of INIA, Rural Extension and DGCSAFER in the WARD project under whatever new institutional arrangement evolves

- The Minister of Rural Development and Fisheries will continue his coordinating role as chair of the Coordinating Council under any new institutional arrangement

The anticipated reorganization of activities into semi-autonomous institutions will theoretically improve cooperation and coordination.

A major participant in agricultural development on the target watershed will be The International Fund for Agricultural Development (IFAD.) See -----. Although WARD and the IFAD project are both specialized, their efforts are complementary. Cooperation and collaboration between the two are essential. Securing this cooperation and minimizing overlap will be a major task for the coordinating council which can be greatly facilitated by close professional relationships among technical and management personnel.

<u>The National Institute for Agrarian Research, INIA</u>

INIA benefitted from institution-strengthening activities (training, technical assistance and commodity import) of USAID/FCRP and other assistance projects. It enjoyed a reasonable priority in government policy and received a fair amount of support. Although small in size, it is considered by some to be a shining example of an agricultural research entity for sub-Saharan Africa.

The current organization of INIA is shown in Figure D.5.6.

This will probably not change significantly if and when INIA becomes part of the National Institute of Rural Development. INIA maintains coordination with other GOCV institutions through a Coordinating Council overseen by the Minister of Rural Development and Fisheries. It's internal policy and priorities are set by a Scientific Council composed by top officials and department heads. More than two thirds of INIA's financial support is from donor agencies mostly in the form of technical assistance, equipment and supplies. INIA staffing and more detail on organization and resources is shown in Annex D.1. INIA has some deficiencies in its professional staffing, particularly in the social sciences, agroforestry, soil science, irrigation and watershed management. Some of this is due to attrition during the past year.

The Directorate General for Soil and Water Conservation and Rural Engineering, DGCSAFER

Like INIA, DGCSAFER benefitted from U.S. and other donor assistance, particularly the Watershed Development Project (WDP). The current organization of DGCSAFER is shown in Figure D.5.7. DGCSAFER is composed of a Rural Engineering Division which is responsible for planning and building soil and water conservation structures, and a Forestry Division which produces and transplants seedlings for its afforestation and reforestation programs. Both divisions utilize large amounts of labor financed by monetized PL 480 food aid.

DGCSAFER's headquarters is at Achada São Felipe, a few kilomenters from Praia, on Santiago. It consists of six modern office buildings, three garages/workshops and a cafeteria. Much of DGCSAFER's heavy equipment is in poor repair. AID has ordered $300,000 of spare parts for this equipment. WARD should consider the need for additional equipment and spare parts in their commodity component.

DGCSAFER has a professional staff of about forty people. Twelve of these have university degrees, are considered senior level and are employed promarily in the technical divisions and senior administration. There are eight mid-level technicians, twelve are classified as "technical professional" and five auxilliary technicians. The major staff deficiency noted by the design team was lack of agroforestry capability in DGCSAFER, which has been taken into account in the training plan.

The General Directorate of Rural Extension, DGER

The rural extension function will be incorporated into WARD through the Coordinating Council and with direct support in training, technical assistance and supplies and/or equipment. See Figure B.4.8 for current organization and Figure D.5.5 for the placement of rural extension in the anticipated institutional scheme under the National Institute of Rural Development.

Legal Status of GOCV Organizations

All major government agencies directly involved in WARD currently form an integral part of the GOCV and the MDRP. The new institute design foresees all these major agencies as parts of semi-autonomous institutes, subject at first to considerable subsidy from the GOCV as well as GOCV "policy guidance." They are expected to become more financally independent over time.

The institutional reorganization raises major questions for WARD. The project is likely to have to shift from a cooperative mode among government agencies (and perhaps between USAID and GOCV) to some sort of contracting mode of doing business. Payments in money can be withheld for non-performance, but payments in other forms such as training, vehicles or technical assistance could hardly be withheld once committed. USAID and the PVO would be obliged to set up some sort of contracting office or section. The Coordinating Council would likely encounter internal conflicts of interest.

Financial Status

Like its predessor projects, WARD is almost wholly funded by the USG. The major financial contribution of GOCV is salaries of government employees which they have demonstrated the capability to pay. This ability is less clear for the anticipated semi-autonomous institutes. The Minister of Rural Development and Fisheries has recognized in conversation with USAID and the PP design team that GOCV will have to be responsible for salaries (even at a higher level), at least in the beginning.

MANAGEMENT

Authority

Lines of authority are fairly well defined under the current GOCV set-up as it affects WARD. See Figure B.4.4. The situation is less well-defined under the anticipated institutional reorganization and semi-autonomy.

Management Capability and Experience

Most of the major GOCV officials and technical personnel to be involved in WARD have experience in predecessor projects and posess the necessary capability. Most of the same people will probably be major players under the anticipated reorganization.

USAID/Praia

USAID/Praia is a small mission and has suffered from lack of

personnel for project management in the past (see Evaluation, P.86.) For this reason, a PSC or local hire project manager has been programmed for WARD.

FIGURE D.5.1 ORGANIZATION CHART OF THE NATIONAL INSTITUTE FOR AGRICULTURAL RESEARCH (INIA)

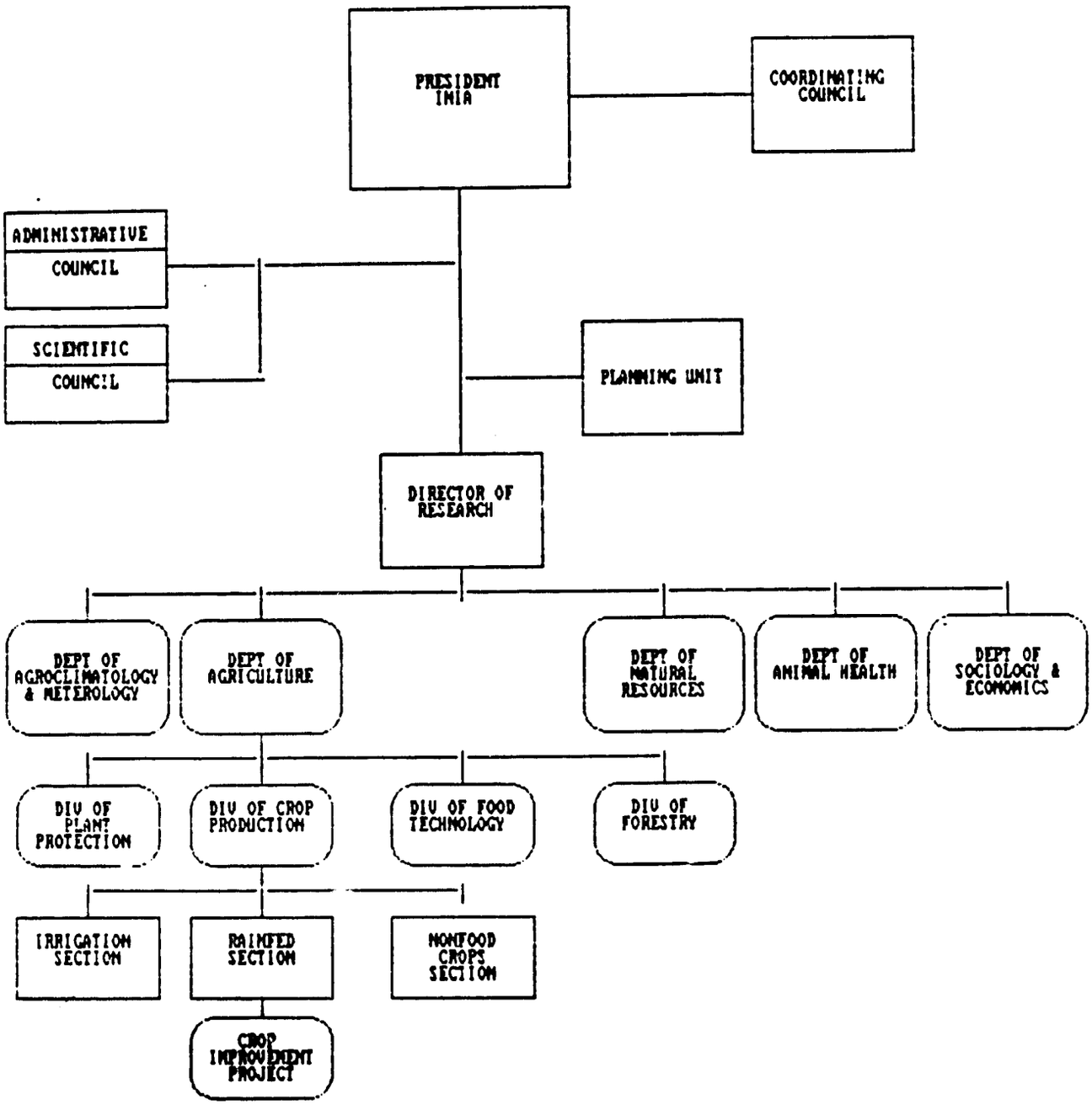

FIGURE D.5.2 POSSIBLE FUTURE WARD COORDINATING COUNCIL

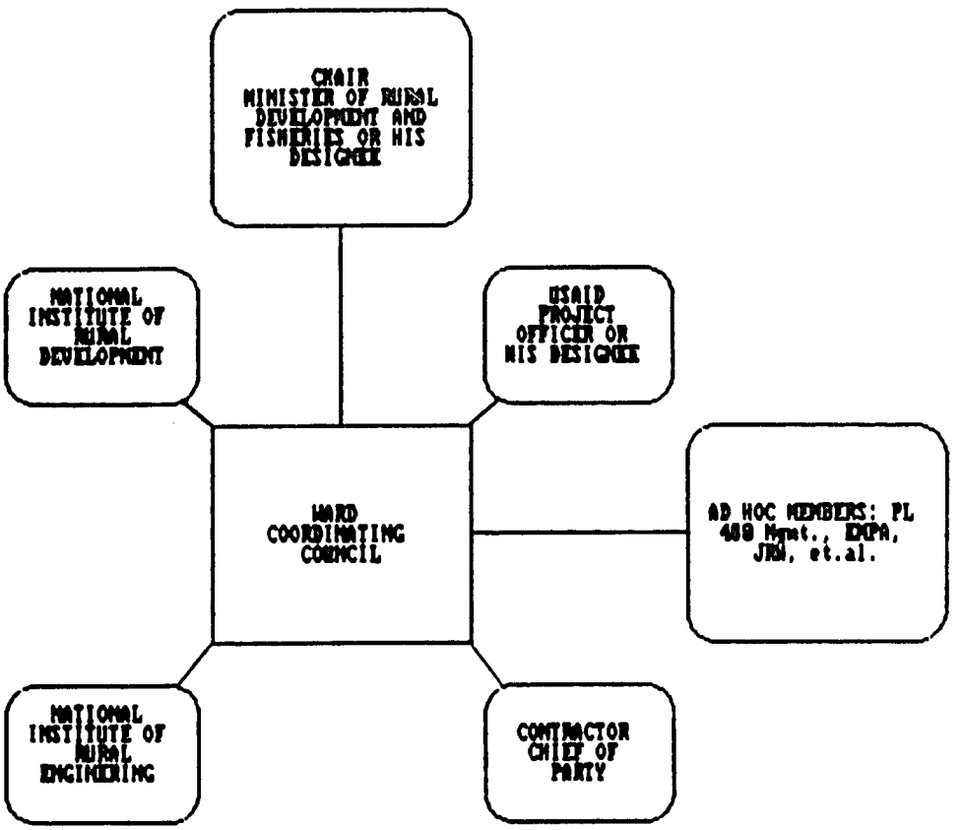

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FIGURE D.5.3 COMPONENTS OF ANTICIPATED NATIONAL INSTITUTES

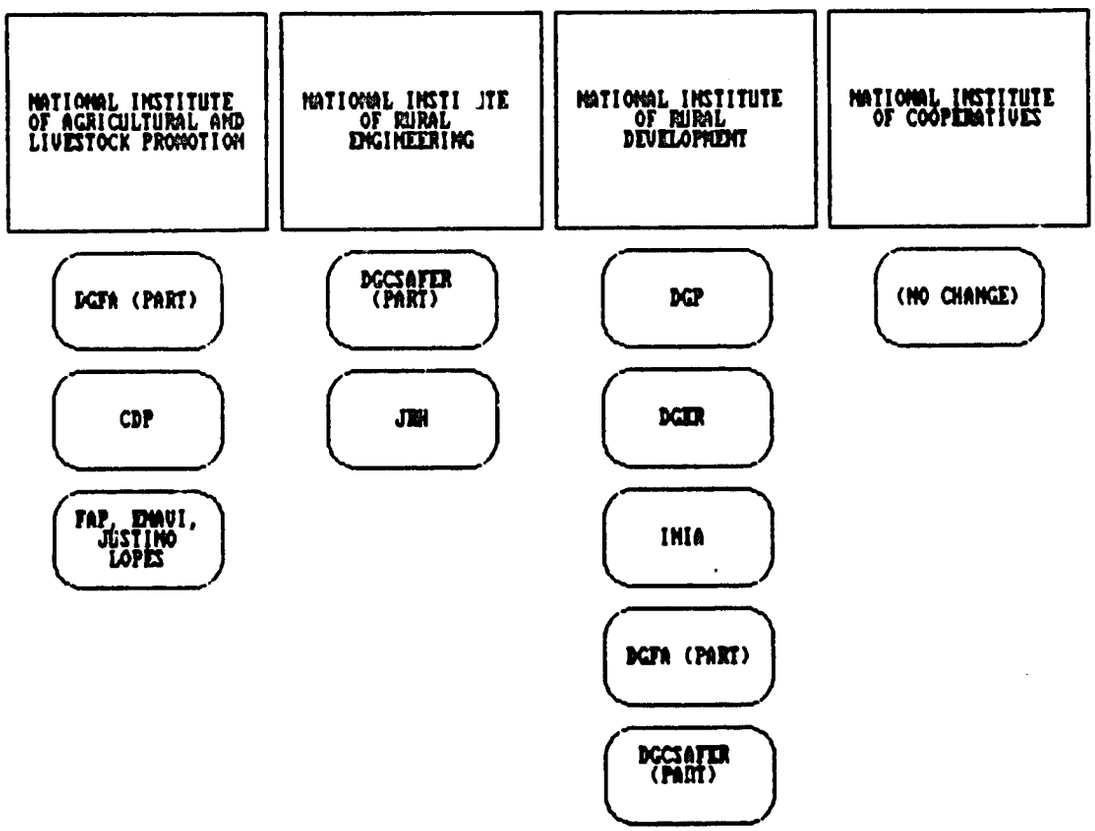
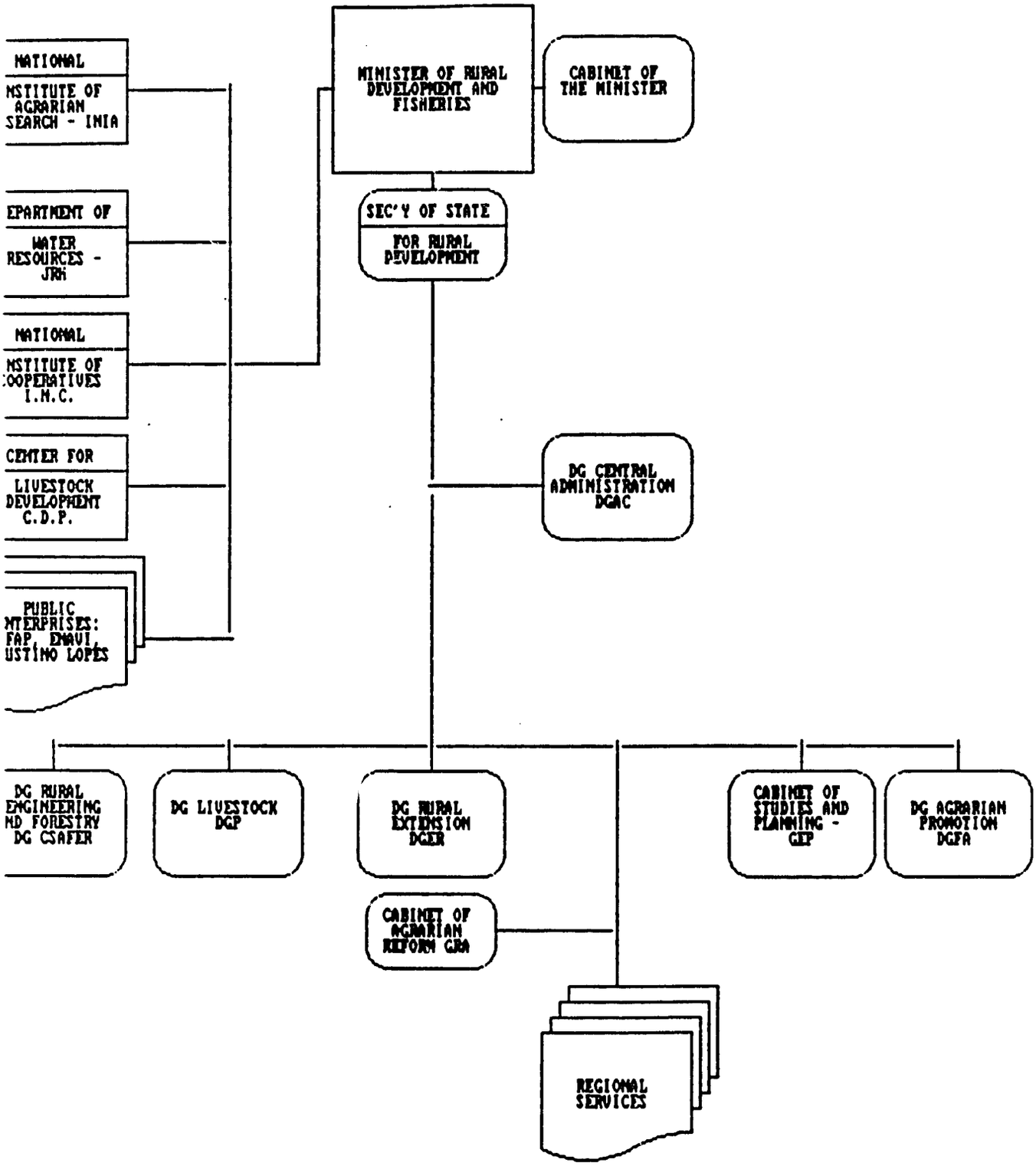


FIGURE D.5.4 INSTITUTIONAL ORGANIZATION - MINISTRY OF RURAL DEVELOPMENT AND FISHERIES



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FIBURE D.5.5 ORGANIZATION OF THE MINISTRY OF RURAL DEVELOPMENT AND FISHERIES

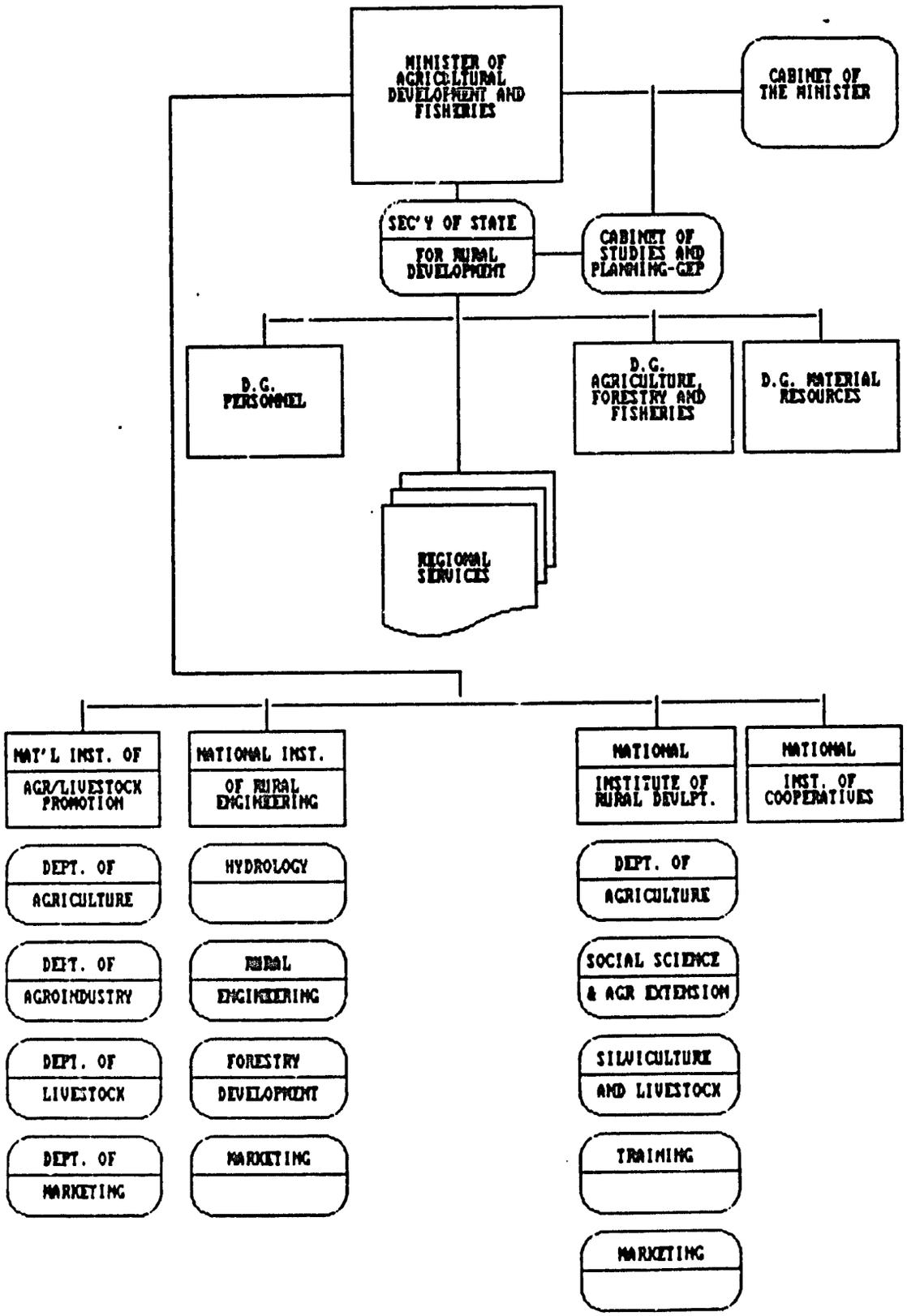

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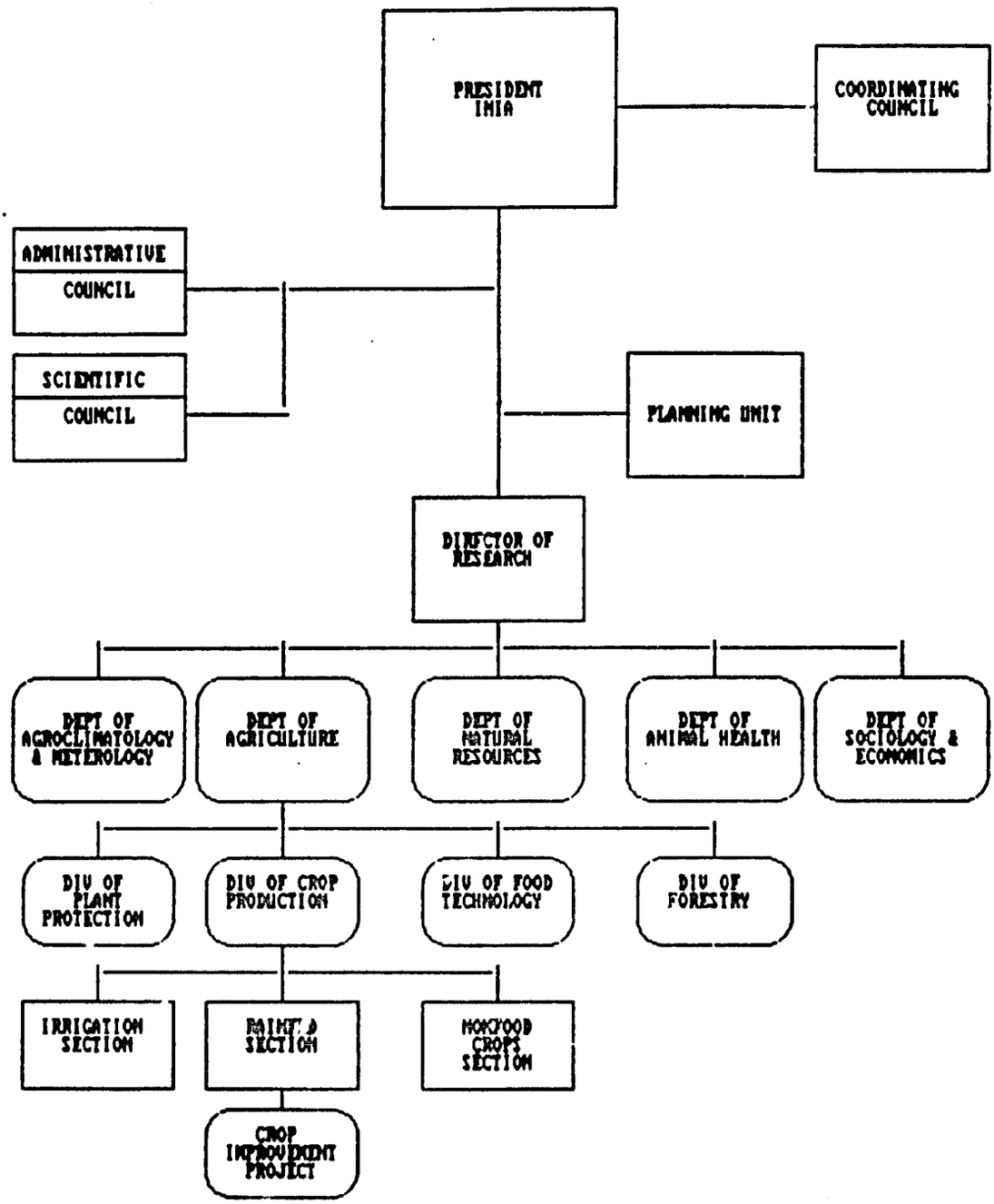
FIGURE D.5.6 ORGANIZATION OF THE NATIONAL INSTITUTE FOR AGRICULTURAL RESEARCH (INIA)



INST-11

FIGURE D.5.7 GENERAL DIRECTORATE OF SOIL AND WATER CONSERVATION AND RURAL ENGINEERING

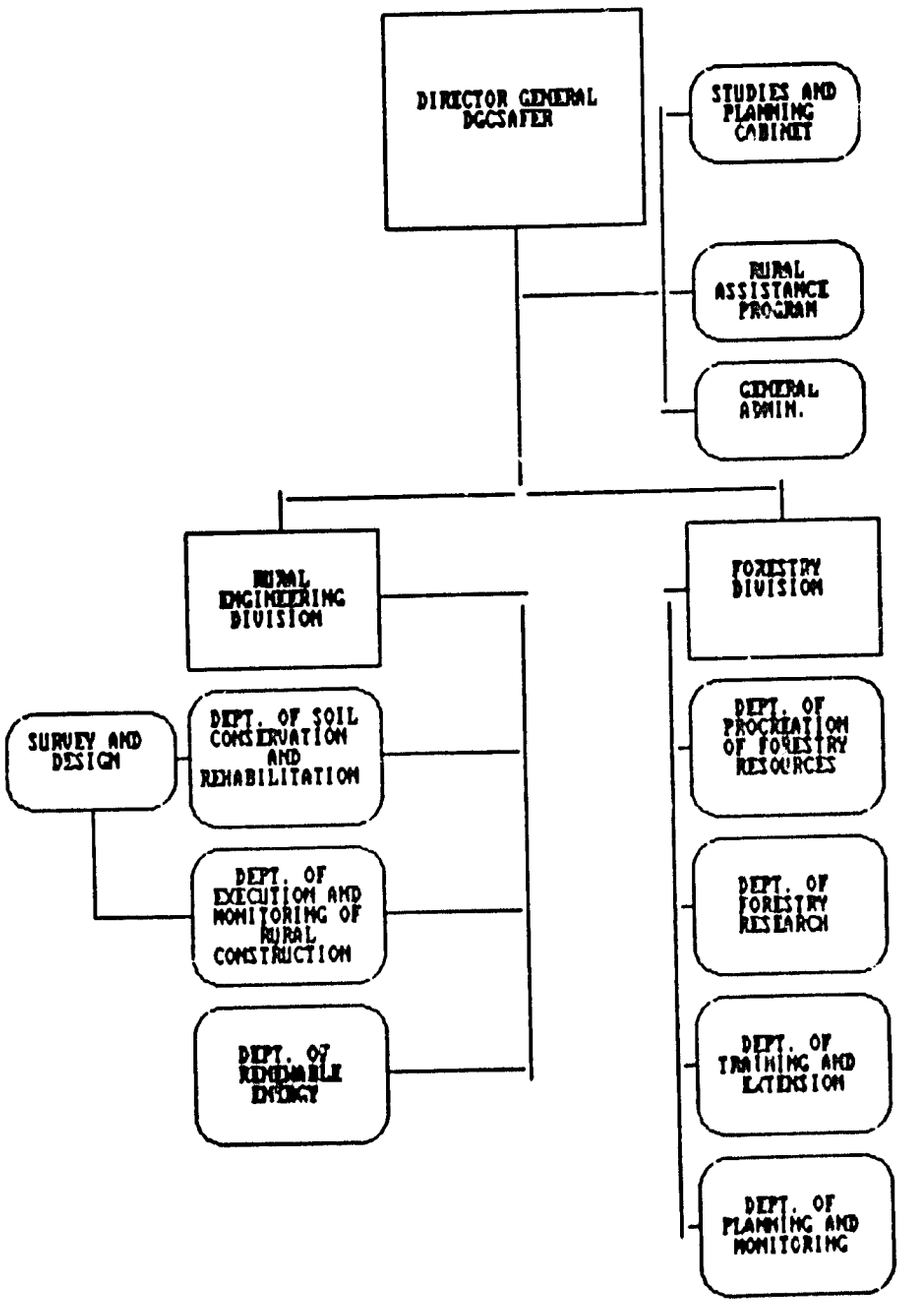


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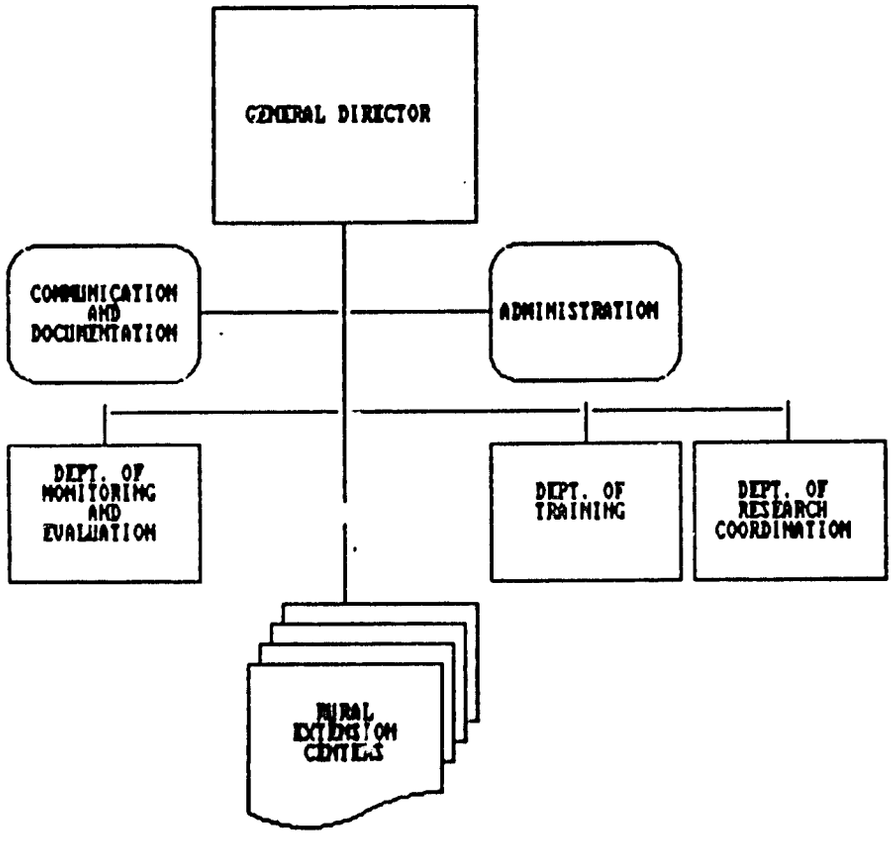
FIGURE D.5.8 ORGANIZATION OF THE RURAL EXTENSION SERVICE



ANNEX D.6 FINANCIAL AND ECONOMIC ANALYSIS

I. FINANCIAL

The purpose of financial analysis is to determine the financial viability of the project (monetary value to the participants) and to assure that the stream of expected expenses can actually be paid for by the participants. Only benefits measureable, or "estimatable" in monetary terms are considered.

The participants are the U.S. Government (USG) and the government of Cape Verde (GOCV) who finance the development efforts of WARD. The beneficiaries fall into a continuum of direct to indirect from the farmers on the target watershed to farmers on other Santiago watersheds to farmers on other islands to Cape Verdian consumers. No attempt was made to include the latter group in the financial analysis although they are sure to benefit from lower prices and better diets. The measureable benefits are mostly from increases in agricultural production.

The total benefits from WARD far outweigh the costs, as shown in Table D.6.1. Even when the time value of money is taken into account, the benefits are impressive for a project of this nature, at least a reasonable "bang for the buck". If the project performs as expected, there will be a positive financial return, that is, the discounted flow of benefits will exceed the discounted flow of costs.

As with any activity dealing with the future, assumptions must be made on the basis of imperfect information. Most of these are apparent from the support tables; others are discussed in the following text.

A. COSTS

The costs of the project are those shown in the project budget. Only WARD costs (USG and GOCV) are included, and benefits include only those resulting from the project. GOCV in-kind contribution is not included. Costs incurred by GOCV and other donors beyond the PACD are not considered although it is assumed that development efforts will continue at an appropriate level.

TABLE 0.6.1
FINANCIAL RETURN TO WARD PROJECT
000 DOLLARS

YEAR	PROJECT COSTS USB	PROJECT COSTS GOCV	PROJECT COSTS TOTAL	PROJECT BENEFITS INCREASED IRRIGATED LAND	PROJECT BENEFITS INCREASED PRODUCTIVITY CROPS	PROJECT BENEFITS INCREASED PRODUCTIVITY LIVESTOCK	PROJECT BENEFITS INCR. FUELWOOD SUPPLIES	PROJECT BENEFITS TOTAL	CASH FLOW
1	1016	1087	2103						-2103
2	2136	1742	3878					0	-3878
3	1591	1387	2978	40	120			160	-2818
4	1422	1219	2641	40	220	150		410	-2231
5	1112	1155	2267	80	450	225		755	-1512
6	975	967	1942	100	550	375	24	1049	-893
7	748	886	1634	100	1100	750	44	1994	360
8				200	1100	750	64	2114	2114
9				200	1100	750	80	2130	2130
10				100	1100	750	96	2046	2046
11				100	1100	750	108	2058	2058
12				40	1100	750	120	2010	2010
13					1400	750	132	2282	2282
14					1400	750	142	2292	2292
15					1400	750	152	2302	2302
16					1650	1125	160	2935	2935
17					1650	1125	168	2943	2943
18					1650	1125	174	2949	2949
19					1650	1125	180	2955	2955
20					1950	1125	168	3243	3243
21					1950	1125	158	3233	3233
22					1950	1125	148	3223	3223
23					1950	1125	140	3215	3215
24					1400	750	120	2270	2270
25					850	375	100	1325	1325
TOTAL	9000	8443	17443	1000	28790	17625	2478	49893	32450
NPV			12500					12601	

IRR= 0.100927
B/C @ 0.1 1.008082

FIN - 1A

B. BENEFITS

Financial benefits from the WARD project accrue from increased irrigated land made possible by soil and water conservation efforts and from increases in agricultural productivity resulting from conservation efforts and agricultural research. Some benefits would likely accrue without the WARD project, but most observers feel that there would be a significant amount of environmental degradation which would result in an overall negative stream of benefits over time "without project."

The total benefits to Cape Verde from all development efforts (GOCV and other donors) will be larger than those shown in Table D.6.1. For example, it is generally believed that 300 hectares of irrigated land can be added to the land base of Santiago island, of which only 50 are claimed to result from WARD. Similarly, total increases in agricultural production resulting from soil and water conservation, flood control and agricultural research are expected to be higher than those claimed as resulting from WARD.

Productive Value of Irrigated Land

Crop budgets developed by the Socio-Economic Studies team at INIA[1] provide a basis for financial analysis of irrigated land on Santiago. Their conclusion was that the production of the major irrigated crops was profitable, and would be profitable even if more realistic water charges were paid. Their findings are summarized on the following page.

---

[1] See CROP BUDGETS FOR SELECTED IRRIGATED CROPS OF SANTIAGO AND SANTO ANTÃO ISLANDS, Socio-Economic Studies Team, Food Crop Research Project and Department of Social Sciences, INIA, September, 1987.

CROP	YIELD T/ha	PRICE Esc/kg	REVENUE 000 Esc	COSTS 000 Esc	NET/HA 000 Esc
Fert. Tomato	40	30	1200	232	968
Sw.Pot/Mand.	9	85	765	142	623
Banana	50	13	650	116	534
Tomato	20	30	600	137	463
Cabbage	15	40	600	144	456
Onion	23	25	579	158	421
Potato	12	40	480	271	209

In order to determine the productive value of irrigated land, the PP team calculated Internal Rate of Return (IRR) over a 20 year period for the above crops. This required the following assumptions:

- Most irrigated plots are supported by some type of structure, the useful life of which is twenty years.
- Maintenance costs average about seven percent per year; higher toward the useful life of the structure.
- Yields will decline during the latter years of useful life.

Table D.6.2 shows the model used in determining the productive value of land for the major crops assuming differing land values. Revenues and costs for years two to twenty were entered in Table D.6.2 for the various crops (from the preceeding text table.) The productive value of land for that crop was then determined by manipulating the LAND COST (for year one) until IRR was 15% (or B/C RATIO was one to one when NPV was calculated at 15%).

The productive value of one hectare of permanently irrigated land is shown on the following page, assuming the producer expects to earn fifteen percent on his investment.

CALCULATION OF FINANCIAL RATE OF RET.
FOR IRRIGATED LAND IN [illegible]
[illegible] ESTUDIO

YEAR	LAND COSTS	NON-LAND COSTS	TOTAL COSTS	REVENUE	CASH FLOW
1	4250.0		4250.0		-4250.0
2	255.0	222	487.0	1200	713.0
3	255.0	222	487.0	1200	713.0
4	255.0	222	487.0	1200	713.0
5	255.0	222	487.0	1200	713.0
6	255.0	222	487.0	1200	713.0
7	255.0	222	487.0	1200	713.0
8	255.0	222	487.0	1200	713.0
9	255.0	222	487.0	1200	713.0
10	297.5	222	519.5	1200	680.5
11	297.5	222	519.5	1200	680.5
12	297.5	222	519.5	1200	680.5
13	297.5	222	519.5	1200	680.5
14	297.5	222	519.5	1200	680.5
15	297.5	222	519.5	1200	680.5
16	297.5	222	519.5	1200	680.5
17	340.0	222	562.0	1140	578.0
18	340.0	222	562.0	1140	578.0
19	382.5	222	614.5	1060	445.5
20	382.5	222	614.5	1060	445.5
TOTAL	9960.0	4406	14366	22440	8074.0
NPV			8414	8447	

IRR	0.151
B-C RATIO	1.004

LAND COST	4250
CAPITAL COST	0.15
YIELD-T/HA	40
PRICE-ESC/YR	30
NON-LAND COSTS	222

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CROP	PRODUCTIVE VALUE Escudos
Fertilized tomato	4,250,000
Sweet potato/ Manioc	2,350,000
Banana	1,825,000
Tomato	1,600,000
Cabbage	1,600,000
Onion	1,500,000
Potato	1,075,000

Varela and colleagues[2] provided similar budgets for typical crop systems in Santiago. These systems include both irrigated and dryland areas, but less than twenty percent of the income was from the dryland area. Dryland area was more than 10 times the irrigated area in these systems, a rough average being 0.08 ha of irrigated land and 1 ha of dryland. Productive values of land per hectare, in escudos, for systems on or near Ribeira Seca watershed (Ribeira dos Picos) are shown on the next page.

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[2]Varela, Raul and Tito Andrade, Mark Langworthy, Timothy Finan. DESCRICÃO E ANALISIS DOS SISTEMAS AGRICOLAS REPRESENTATIVOS EM SANTIAGO. Departamento das Ciencias Social e Economia Agricola, INIA, Maio, 1989.

SYSTEM	PRODUCTIVE VALUE
System 1	1,940,000
System 2	1,974,000
System 4	3,675,000
System 5	1,875,000

System 1 is described as "small subsistance", System 2 as "small subsistance without orchard", System 4 as "small holding oriented to banana and manioc" and System 5 as "small holding specializing in sugar cane". The dryland cropping pattern was corn and beans in all cases. System 4 farms were located near the mouth of the ribeira and had much better water supplies; hence the higher land values. See publication cited for description of the systems.

Productive value of irrigated land ranges from about one to four million escudos per hectare, roughly $13,000 to $53,000 - valuable land by most any agricultural standard. Unfortunately, there is no reliable estimate of land development costs, nor is there an established market for agricultural land. The conservative value of $20,000/ha was used in calculating IRR in Table D.6.1.

Increased Productivity

Table D.6.3 shows the assumptions and methodology used in calculating benefits from project activities on rainfed land, irrigated land, from livestock and from forestry on Santiago island. Spillover effects of WARD activities to other islands has not been considered in this analysis.

- Irrigated Land

The PP team estimates the current (1990) farm level value of irrigated crops on Santiago at $6,000,000. This serves as a base for calculating future benefits due to project interventions as shown in Table D.6.1. It is assumed that benefits will increase by two percent per year of total value of production beginning in year three of project life, will gradually rise to 20 percent by year 20

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and tail off to 10 percent in the last year covered by the analysis of benefits and costs. See Table D.6.3. Twenty-five years was the period chosen for analysis as most costs will have been discounted to insignificance after 25 years.

- Rainfed Land

Annual benefits due to the project were calculated from the best estimate we could obtain of the value, at farm gate, of crop production and an assumed schedule of yearly production increases due to WARD interventions. The schedule of annual production increases is less than that assumed for irrigated production because WARD concentrates on irrigated land and IFAD has a rainfed project on Santiago island. Key estimates and assumptions are that 1) the annual value of rainfed agriculture is $5,000,000 and 2) the schedule of yearly percentage increases in production due to the project shown in Table D.6.3.

- Livestock

The current value of livestock products (meat, dairy products, eggs and hides) was taken primarily from a 1990 MDRP publication RELATORIO DE ACTIVIDADES, EXERCICIO 1989, from the General Directorate of Livestock. The schedule of benefits due to the project is the same as the schedule for dryland crops.

- Firewood

The project benefits from tree planting are two-fold: soil/water conservation and fuelwood. Only increased values of fuelwood are taken into account in this analysis because the bulk of the benefits of conservation measures are reflected in increased crop and livestock production, and the other benefits from tree planting such as aesthetic value are not measureable in monetary terms. Assumptions are that trees planted at the beginning of the project will begin to yield firewood after six years. The annual yield of firewood will be about one ton per 2,000 trees at first, increasing to 1.5 tons as the trees mature. The schedule of tree plantings on project watersheds, as discussed in Annex D.3, is shown on the following page.

PROJECT YEAR	NUMBER TREES
1	600,000
2	500,000
3	500,000
4	400,000
5	400,000
6	300,000
7	300,000

Firewood is currently valued at $80 per ton.

TABLE 3.6.7 WARD PROJECT BENEFITS CALCULATIONS
IN DOLLARS

YEAR	INCREASE IN LAND # HA	INCREASE IN LAND VALUES VALUE	INCREASES IN PRODUCTIVE VALUE: IRRIGATED CROPS % INCR base =	IRRIGATED CROPS VALUE 6000000	DRYLAND CROPS % INCR. base =	DRYLAND CROPS VALUE 5000000	TOTAL VALUE CROPS	LIVESTOCK % INCR. base =	LIVESTOCK VALUE 7500000
1									
2									
3	2	40	2	120			120		
4	2	40	2	120	2	100	221	2	150
5	4	80	5	300	3	150	450	3	225
6	5	100	5	300	5	250	550	5	375
7	5	100	10	600	10	500	1100	10	750
8	10	200	10	600	10	500	1100	10	750
9	10	200	10	600	10	500	1100	10	750
10	5	100	10	600	10	500	1100	10	750
11	5	100	10	600	10	500	1100	10	750
		2.	10	600	10	500	1100	10	750
13			15	900	10	500	1400	10	750
14			15	900	10	500	1400	10	750
15			15	900	10	500	1400	10	750
16			15	900	15	750	1650	15	1125
17			15	900	15	750	1650	15	1125
18			15	900	15	750	1650	15	1125
19			15	900	15	750	1650	15	1125
20			20	1200	15	750	1950	15	1125
21			20	1200	15	750	1950	15	1125
22			20	1200	15	750	1950	15	1125
23			20	1200	15	750	1950	15	1125
24			15	900	10	500	1400	10	750
25			10	600	5	250	850	5	375
	50	1000		17040		11750	28791		17625

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II. ECONOMIC ANALYSIS

A complete economic analysis of the WARD project is not possible with the resources allotted to the PP team. Studies would have to be carried out which are beyond the scope of work. At any rate, such an analysis is not needed to justify the project as the Financial Analysis is positive. Since economic analysis uses shadow prices to determine social feasibility of a project, the economic returns are likely to be even higher than the financial returns. A major component of the costs of the WARD project is labor, financed by sale of commodities. The opportunity cost of labor on Cape Verde is less than its monetary cost because of unemployment and lack of alternate opportunity. Work front type projects and food for work programs should theoretically pay for labor at or slightly above the opportunity wage rate. Political considerations have prevailed in Cape Verde, partly because the opportunity cost is very low and partly because it is politically expedient to augment rural incomes in this manner.

In order to obtain an idea of the socio-economic returns to the project, work front payments were reduced to roughly 55 percent of their monetary value shown in Table D.6.1, and land values were reduced by about 25% to reflect more closely their true economic value. Although this had a balancing effect, IRR increased from 10% to 12.5%. This does not take account of other social and economic benefits such as lower prices to consumers which are expected to result from more efficiency in agricultural production. Were it possible to consider all project benefits, IRR would probably be on the order of 20% to 25%.

TABLE D.6.2

CALCULATION OF FINANCIAL RATE OF RETURN

FOR IRRIGATED LAND ON CAPE VERDE

000 ESCUDOS

YEAR	LAND COSTS	NON-LAND COSTS	TOTAL COSTS	REVENUE	CASH FLOW
1	4250.0		4250.0		-4250.0
2	255.0	232	487.0	1200	713.0
3	255.0	232	487.0	1200	713.0
4	255.0	232	487.0	1200	713.0
5	255.0	232	487.0	1200	713.0
6	255.0	232	487.0	1200	713.0
7	255.0	232	487.0	1200	713.0
8	255.0	232	487.0	1200	713.0
9	297.5	232	529.5	1200	670.5
10	297.5	232	529.5	1200	670.5
11	297.5	232	529.5	1200	670.5
12	297.5	232	529.5	1200	670.5
13	297.5	232	529.5	1200	670.5
14	297.5	232	529.5	1200	670.5
15	297.5	232	529.5	1200	670.5
16	297.5	232	529.5	1200	670.5
17	340.0	232	572.0	1140	568.0
18	340.0	232	572.0	1140	568.0
19	382.5	232	614.5	1080	465.5
20	382.5	232	614.5	1080	465.5
TOTAL	9860.0	4408	14268	22440	8172.0

NPV			6414	6442	
IRR		0.151			
B/C RATIO		1.004			
LAND COST		4250			
CAPITAL COST		0.15			
YIELD-T/HA		40			
PRICE-ESC/KG		30			
NON-LAND COSTS		232			
	06-Aug-91				
	CVIRR2.WK1				

ANNEX D.7

PROJECT PAPER DESIGN

INITIAL ENVIRONMENTAL EXAMINATION
or
CATEGORICAL EXCLUSION

PROJECT COUNTRY: CAPE VERDE

PROJECT TITLE: WATERSHED AND APPLIED RESEARCH DEVELOPMENT (655-0017)

FUNDING: FY(s): 1991-1998 US$: 19 Million

IEE PREPARED BY: Mr Idrissa SAMBA, REDSO/WCA, Regional Environmental Advisor

ENVIRONMENTAL ACTION RECOMMENDED:

Positive Determination:	
Negative Determination:	
Categorical Exclusion :	XXXXXXXX
Deferral :	

SUMMARY OF FINDINGS:

Recommended environmental actions for the project activities are:

Agroforestry and sylvopastoral development is recommended for categorical exclusion under 216.2(c)(2)(iii) for the study component; under 216.2(c)(2)(ii) for the technology packages development; and under 216.2(c)(2)(i) for the extension and training component.

The institution building and reform assistance to DGCSAFER and INIA component of the project can be recommended for categorical exclusion under 22 CFR 216.2 section (c)(2)(xiv).

The applied research component for agriculture and forestry is recommended for a categorical exclusion under 216.2 (c)(1)(iii) or 216.2 (c)(2)(iii).

The training and technical assistance components are recommended for categorical exclusion under regulation 22 CFR 216.2 section (c)(2)(i).

The commodity import program including vehicles, spare parts, office equipment, motor pumps, computers and other equipment is recommended for categorical exclusion under 22 CFR 216.2 section (c)(2)(xii).

The PVO managed Title II food assistance portion of this project is recommended for categorical exclusion under regulation 22 CFR 216.2 section (c)(2)(xi).

Since on-farm and off-farm soil and water conservation activities, as well as irrigable land development, are funded through generated local currencies, they do not fall within the purview of Regulation 16. However, the IEE preparer suggests that an environmental follow up of the project activities be carried out simultaneously with the project implementation in the form of a monitoring/mitigation system to minimize possible adverse effects and guarantee the safety and security of the rural poor.

While not currently contemplated, if the commodity imports include pesticides they will be subjected to review pursuant to 22 CFR 216.3(b) and will require clearance before importation and use. A covenant is necessary to prohibit use of project funds or local currency for the purchase or importation of pesticides.

CLEARANCE:

Mission AID/Rep : Mr Thomas LUCHE DATE: 8/06/91

CONCURRENCE:

Bureau Environmental Officer: APPROVED: X
DISAPPROVED:
DATE: 9/20/91

CLEARANCE:

GC/Africa: STATE 314208 DATE: 9/20/91

1.0 *PROJECT DESCRIPTION*

The Cape Verde Watershed and Applied Research Development (WARD) Project is a seven year, $19 million effort designed to conserve and improve the natural resource base and enhance sustainable agricultural productivity of twelve watersheds of Santiago Island, one of which, Rebeira Seca (6830 ha total and 7% of the total arable area of the Santiago Island), is given special attention for research and monitoring reasons. The objectives of the project are to research and extend sustainable soil and water conservation technology and practices using applied on-farm research within the project area. The institutional capacity building initiatives, technical assistance, training, soil and water conservation activities, and commodity assistance will have a potential spread effect throughout Cape Verde. The activities which will be undertaken to achieve the project objectives include: technical assistance to INIA and DGCSAFER to enhance institutional capacity and planning capabilities; support of a mechanism for extending INIA developed research methodologies to field sites; reinforcement of linkages among GOCV institutions in the area of natural resources and agricultural development; and a PL-480 food program. USAID will provide support to the Cape Verdean government for these activities via two channels.

First, nine million dollars ($9,000,000) of DFA funds will be used for project activities. Uses will include a grant to a U.S. PVO and University which will provide project management and technical assistance services under a cooperative agreement. Also included will be training, applied research, analysis, extension services, watershed protection plans, logistical support, designing and carrying out local awareness campaigns, monitoring, mitigation, and commodity procurement including vehicles, spare parts, office equipment and computers. Other commodities, of a type as yet undefined, will also be procured, but these will not include pesticides.

Second, USAID will provide the GOCV with $10 million in local currency generated through a PL-480 monetized Title II food assistance program. These local currencies will be used to pay the Classical and Community-based Workfront workers. The workfronts will build a limited number of structures including check dams, sediment retention structures, and water harvesting

facilities. They will also grow seedlings and plant trees for future benefit including canopy formation, shade, soil erosion control, wind protection, and for fuelwood, food, fodder, and fertilizer. Local currency will be used as well to obtain local services, locally available supplies, and equipment.

The Government of Cape Verde will additionally provide personnel, office space, and recurrent cost resources. Field-level operations will be conducted in conjunction with a rural employment/work program, in support of pilot watershed activities, and as part of a community-based watershed infrastructure maintenance system.

This project is a soil and water conservation and adaptive research project whose ultimate objective is to increase sustainable agriculture productivity throughout the selected watershed and eventually the entire country. Confusion may at times arise due to fuzzy definitions or the use of inappropriate terms by individuals not conversant with the extremely degraded nature of the target watershed and the planned interventions. Confusion aside, this is not a river basin development project, an agricultural land leveling project, or an irrigation/water management project including dams and impoundments. An Environmental Assessment is inappropriate for this project.

2.0 PROJECT ACTIVITIES AND INPUTS.

The activities and inputs involved in the achievement of project objectives are examined under AID regulation 22CFR216 to concur with the AID policy that is to: (1) "ensure that the environmental consequences of AID financed activities are identified and considered by AID and the Host Country prior to final decision to proceed and that appropriate environmental safeguards are adopted; (2) assist developing countries to strengthen their ability to evaluate the effects of development strategies and projects and implement effective environmental programs; (3) identify impacts of AID's action upon the global environment which affect the common and cultural heritage of all mankind; and (4) define environmental limiting factors that constrain development and carry out activities that restore the renewable resources base."

The following is a tentative outline of the activities and inputs involved in the WARD project and a statement on their funding sources:

2.1 Soil and water conservation activities

- On farm soil and water conservation: mainly funded with local currency, and project funds for technical assistance aspect.
  * Design and application of land use systems.
  * Contour practices: hedgerows, strip-cropping, contour tillage.

- Off farm soil and water conservation: funded with local currency generated from the PL480 program.
  * Structures: dams, gully plugs, drop-inlet spillways. These are intended to retain sediment and store water (creation and improvement of sand aquifers, and wells). It is planned to (a) build 30 drop-inlet structures in the Ribeira Seca and 300 others in the other eleven watersheds; (b) build 5 major cross-channel structures in the Ribeira Seca and 20 others in the remaining 11 watersheds; and (c) rehabilitate and upgrade 40 hydraulic structures. These structures are intended to generate positive changes on the environment and the natural resources profile; however, some adverse effects may occur.

- Develop irrigable lands: funded with local currency, and the participation of the farmers on private lands.
  * Land leveling and terracing of 9 hectares for irrigation in the Rebeira Seca watershed,
  * construction of 10 Km of lined canals,
  * construction of three diversions for water conveyance,

- Irrigation is intended to fulfill one of the objectives of the project, to increase food production. Although the area planned to be irrigated is small adverse effects on the environment may occur.

2.2 Forestry activities

- Project funds support to DGCSAFER for afforestation and institution building.

- Research on forestry, agroforestry and sylvopastoral activities.

- Agroforestry and sylvopastoral development: mainly supported by local currency funds, with project funds for technical assistance.
  * development of technology packages,
  * implementation of agroforestry systems,
  * studies of market strategies,
  * extension and training of farmers.

- Promotion of private sector activities.
  * study of private sector activities in seedling and charcoal production, tree planting, fuel wood harvesting, marketing,
  * evaluation of currently working enterprises.

2.3 Agricultural research activities

- Institutional support:
  * on farm research methodology,
  * research management
- Applied research:
  * water management research,
  * cropping systems development,
  * varietal development.

- Monitoring and evaluation.

2.4 Support activities.

- The activities above involve training at different levels (graduate, agriculture assistant, and farmer level) and commodity procurement.

3.0 *BACKGROUND ENVIRONMENTAL INFORMATION*

Location: The Cape Verde archipelago is located 650 kilometers off the west coast of Africa between latitudes 14°48' to 17°12' W and longitudes 22°41' to 25°22' N. The twelve selected target watersheds lie on the windward side of Santiago island. Ribeira Seca, the largest of the 12 watersheds where WARD is going to work, is given special attention for research, data collection and monitoring purposes.

Climate: The climate is characterized by a short rainfall period with scarce rain and a long dry season.

Swept by the Northeast trade winds of the tropical thermodynamic cell and affected by the Intertropical Convergence Zone, Cape Verde has a typically sahelian climate with persistently sparse rainfall and long periods of severe drought. When the island does experience rain, it is usually a deluge from an intense torrential storm. The average temperatures range from 20°C to 25°C.

Topography: Torrents may drop as much as 1400 meters while plunging from the steep slopes of basalt, basanite, or other volcanic materials derived soils to deposit their alluvial debris in river bottoms or the ocean often less than ten kilometers downstream. In Ribeira Seca's upper reach only 27% of the land has less than 15% slope, 39% of the land between 15 and 30%, 17% between 30 to 50% and the remaining slopes, 17%, above 50%. The slope category of the land determines its suitable use.

Geology: The Cape Verde archipelago has a volcanic origin and includes mountainous islands such as Santiago and Fogo as well as flat islands like Maio. Most of Santiago Island is basalt and lava: breccias, pumice, and pillow lava.

Soils: Shallow, erodable soils with variable quality and depth, cover 65% of Santiago. Brown to reddish-brown sandy, to clayey loam soils predominate in areas used for rainfed agriculture. These stony, shallow, and clayey loam soils contain very low amounts of organic mater and consequently retain limited amounts of water. Young volcanic soils suitable for agriculture occupy only 23% of Santiago Island.

On denuded slopes, the light and loose Tertiary Era pyroclastic soils of the Pico da Antonia volcanic series are very susceptible to runoff and are carried by the turbulent flow over exceptionally steep and rocky slopes and gorges to the ocean. The stream beds are so steep and the runoff so fast that in most places the finer sediments are flushed to the sea. Erosion reduces fertility by depositing significant amounts of sediment in the lower watershed.

Hydrology: None of the twelve project area water courses are perennial, and even domestic wells and springs often must be rationed, or in fact dry up during dry periods. The majority of the water which arrives on the island from all too infrequent rainstorms is lost to the sea.

Vegetation: Typically, the vegetation on Santiago resembles African northern sahel savannah in transition to desert. Years of drought, overgrazing, and intense exploitation for fuel have altered the natural environment to the point where practically no natural vegetative associations exist. Most of the vegetation consists of introduced exotics, cultivated types and weeds with only 92 of the 600 species surveyed (Chevalier 1935) being endemic vegetative forms. Most of the time, vegetative types unpalatable to animals remain on the rangelands. Field observation and documents show the presence of a number of species, mostly introduced, on Santiago Island. A small sample include: Jatropha spp, indigo, Acacia seyal, Acacia albida, Borassus spp (2 isolated individuals) and other palm trees. Planted Prosopis spp dominate the entire Santiago Island and might turn out to be a pest under certain conditions. Vegetative recolonization in protected areas is relatively strong especially with annual grasses and shrubs, but presents a risk for bush fire during the dry season.

Fauna/ Wildlife: The native fauna of the Cape Verde Islands has been described as depauperate and consists almost entirely of birds and lizards. There are no fresh water fish, amphibians (except few frogs dwelling in the wells), or snakes. The only native mammal is the long-eared bat (Plecotus austriacus). The Senegal green monkey has been introduced as have rats, mice, and dogs. The nineteen species of butterflies are all common species of African origin. The Cape Verde Warbler inhabits the project area and is very prolific. Observed in the field were the following species: falcons, pigeons, wild guinea fowls (Numida meleagris galeata) and Coturnix coturnix inopinata. Studies have shown that the following bird species are present in the archipelago: six species identified as useful, three species of predators, six species of rare to very rare, five species of scientific interest and ten marine species.

Major Ecological Problems: Desertification and shortages of domestic and agricultural water are a major threat to the archipelago. From 1700 to 1960, short periods of drought lasting 2 or 3 years have been recorded. But since 1968, drought frequency has increased, lasting longer and disrupting more and more the ecosystem equilibrium. This is aggravated by unsustainable agricultural practices (fields on steep slopes, no land conservation/regeneration practices) and vegetation cover depletion for fuelwood. Most areas are susceptible to wind and water erosion. The water table is very sensitive to rain deficit: the impacts of the 1989 deficit still affect the depth of the water table.

Water shortage, inappropriate land use, high runoff, high erosion rates, soil quality depletion and fuel shortage are the primary environmental problems in Cape Verde today. A shift away from the continuous and destructive practices of subsistence farming and the implementation of fundamental measures to conserve and restore the resource base will be necessary before the land's full potential can be realized. WARD's effort to conserve and improve the natural resource base and agricultural productivity in twelve targeted watersheds is expected to significantly improve the environmental profile of Santiago Island.

Current Biodiversity Profile: The biodiversity of the project area is relatively limited: no large mammals, few reptiles (no snakes), birds and rodents, few native trees. However, introduced trees became endemic. Studies carried out by the INIA Research Center list the following sample major species:

Plant species: Acacia rubra/Delonix regia, Cassia occidentalis, and some endemic to the islands, introduced or not: Launea melanistigma, Asteriscus spp, Periploca chevalieri (medicinal plant), Indigofera tinctoria, Euphorbia tukeyana, Micromeria forbesii, Datura innoxia, Cajanus cajanus.

Bird species include: (a) Predators: Corvus ruficollis (Somali crow), Passer ispaniolensis (sparrow, recently introduced, it has a high multiplication rate), Estrilda estrild (abundant in Santiago Island, it attacks crops such as tomatoes); (b) Useful birds: Sylvia Atricalpa, S. Conspicillata orbitalis, Acrocephalus Brevipennis (the Yellow wagtails family), Hacyon leucocephala that feeds on grasshoppers, Falco tinnunculus (falcon), abundant, feeds on grasshoppers and lizards, as well as Tyto Alba detorta (Barn owl), Coturnix coturnix inopinata (Common quail); (c) rare species: Himantopus himantipus (common stilt), Gallinula chloropus (Common gallinule) limited because of rare wet lands, Ardea purpurea (Purple heron); (d) species very rare or almost extinct: Anas angustirostris (marble duck), Falco peregrinus (peregrine falcon), Buteo buteo bannermani (common buzzard); (e) species with scientific interest: Ardea purpurea, Acrocephalus brevipennis, Tyto Alba Detorta, Passer Jagensis (moineau); (f) and ten species of marine birds.

Human Population: The population is by some estimates up to 70% of mixed Portuguese and African descent, 28% African and the rest of European origin. The population of the archipelago is estimated to be about 336,798 in 1990 (Direccao Geral de Statistica) with a 2.7% growth rate, of which approximately 75,000 live in the project watersheds. Cape Verde is the most densely populated of any of the Sahelian countries with an average density of 500 persons per square kilometer. Cyclical drought, famine, and emigration have reduced the numbers of inhabitants over the centuries until currently over twice as many people of Cape Verdean descent live overseas than live on the islands. Remittances play an important role in the national economy amounting to roughly half of the trade deficit.

Socio-cultural considerations: Social considerations are mainly population and farmers behavior towards the natural resources and the environment as well as their exploitation (agriculture, livestock) practices (See appendix D.4, Social Soundness analysis). Farmers cultivate steep slopes and hoe downward. No land improvement is made although most of the lands are continuously exploited. Thorn brush that builds and fertilizes soils such as Acacia albida is not welcome in the fields. On most upland areas maize is continuously planted. On pasture lands overgrazing is prevalent; however, agriculture and livestock are well integrated compared to other African countries. This can be advantageously developed into agropastoral, environmentally sound types of activities. Involvement of the farmers in the research/extension process seems to be limited.

Agriculture: Traditional small-scale subsistence agriculture based upon mixed farming techniques is the most common means of livelihood on Santiago. Prefered crops are corn and beans which are normally intercropped on rainfed fields. On Santiago Island, rainfed agriculture occupies 20,000 ha. Livestock and poultry include sheep, goats, pigs, chickens, muscovy ducks, and Guinea fowl, with horses, donkeys and mules serving as beasts of burden. Concelho de Santa Cruz, that includes Rebeira Seca, has according to the 1988 agricultural census: 2082 cattle, 5004 goats, 44 horses, 1118 donkeys, 32 mules, 6430 pigs and 10,650 poultry. Cash crops grown primarily in irrigated bottom land plots include sugarcane, cassava, sweet potatoes, bananas, garden vegetables and fruit trees.

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4.0 *IMPACTS AND ISSUES*

General Issues: Soil and water conservation practices intended to be developed and extended during the project will have a positive environmental effect by attenuating storm water runoff and reducing soil erosion. The labor intensive methods are designed to provide employment while leaving a very light environmental foot print. The planting and protection of sustained yield forests and woodlots will will provide wood resources and have a positive effect on the carbon balance. Water quality in seasonal water courses and offshore in lobster and artisanal fishing areas will be improved by the reduction in silt load.

Mitigation measures suggested include the production of detailed watershed development plans on a scale of 1:12,500 for each subbasin in each watershed before commencing the remedial work. Mitigation measures usually include monitoring, planning, and adjustments.

Direct Impacts of Engineering Design/barrage construction: The structures proposed in project activities are likely to have the most identifiable direct impact on the environment. There is considerable environmental risk posed by large, main-channel structures. While this risk can be minimal if engineering design procedures are adhered to, there is need to bear in mind that not all of the existing structures were properly designed. There is also a need to take into account that these structures are constructed in series, and that there could be a chain effect in which failure of one could trigger failure of the others. The risk of dam failure varies according to age of the structure, its design, and the occurrence and magnitude of random floods. Although a cross-channel structure fills with sediment, it initially operates as a reservoir. Assuming a reservoir filled with water fails, the effect of a breach would vary according to whether it was sudden or slow, and the amount of water contained in the reservoir. The worse case scenario is of a sudden breach of a filled reservoir. This water would cascade down the channel, probably overtaking any downstream dams and add in their volume of water and sediment to the flood wave. This would likely damage or destroy any down stream irrigation area and roadways.

The probability of failure is expressed in the design specifications. Assuming a dam filled with sediment fails, the breach would likely be slow and limited to the part that failed. The worse case would

involve a mix of water and sediment similar to a debris flow cascading down the mainstream channel. As with water this would engulf or damage downstream structures, probably causing their failure. It would likely deposit large volumes of sediment over irrigated fluvial terraces. The worst of all possible cases would be a mix of these two events, high volume of water associated with high volume of sediment involving a series of breaches as the flood wave advanced downstream.

Improved engineering design will lower this risk but not prevent it. WARD will rehabilitate existing structures by building contracted spillways on the dam crest and adding discharge aprons and possibly energy dispersors at the dam foot. Ideally, the water discharged by these devices should be sub-critical when it reenters the stream channel. As these structures age their failure risk increases because of settling and shifting of rocks within the gabion, wire failure, corrosion and other causes.

Previous projects have supported rock wall construction mainly to limit soil erosion and silt transport into irrigated zones. The positive effects appear limited although officials claim that statistics show significant changes (see IFAD). Walls are too far apart and soil erosion continues because farmers totally clear the land without any soil conservation practices. Complementary soil conservation methods, other than tree planting, have never been implemented conjointly with structures for erosion/sediment control.

Biodiversity issues: An expected effect of the project is to improve the biodiversity profile of the country, especially with the use of a variety of plant species for afforestation. This assumes that the project does not support monoculturing of *Prosopis spp* and develops conditions for diversification. Reforestation and protection of vegetated areas will significantly contribute to the multiplication of endemic local species currently limited in number. Plant species diversification and multiplication resulting from project activities could have synergetic positive impact on birds, reptiles and small mammals.

Water Quality: Water quality is already a problem, especially for drinking water. Wells in the water course channels are shallow, yield little water especially in dry years, and are not well maintained. The wells observed by the team are dirty with all sorts of things dropped in. Structures, by retaining sediment and increasing aquifer depth, increase the availability of drinking water in the wells. Well protection and maintenance will significantly improve water quality.

Vegetation Impacts: A significant impact on vegetation produced through activities of previous projects is the prevalence of Prosopis spp in Santiago island. This might become a risk in the way that a monoculture plantation is usually sensitive to insect and disease attacks. Another concern is that prosopis is very competitive and often inhibits the development of other plants. It shoots the roots very deep to the water table and evapotranspirates considerable amounts of water. Large numbers of this plant can seriously deplete the already scarce water resources, particularly in channel bottoms.

The overall effect of the WARD project is expected to be, among other benefits, an increase in vegetation cover. With diversification, already started in AID-funded nurseries, WARD's impact on vegetation cover improvement will increase. Diversification can most likely be achieved with sahelian species and exotic species such as Acacia holocericea (already used for replanting along with other Australian species) and Leucaenia spp if suitable.

Impacts on Wildlife: WARD's impact on wildlife is most likely to be positive, especially through habitat improvement by afforestation. Where vegetation cover is allowed to regenerate and recover, increases in wildlife can be observed. Guinea fowls (returned to the wild), pigeons and other birds colonize reforested areas. Afforestation and vegetation diversification can significantly improve bee keeping activities.

Land Use Conflicts: In the project area land can be classified according to slope. Each land slope group has specific potentials and project activities encourage land use according to their capacity and potential. Land use conflicts are not likely to happen. Currently almost all available lands for agriculture in the project area are under owner or farmer control. Land ownership systems have been adopted by farmers for a very long time and do not seem to favor conflicts among users (See appendix D.4, Social Soundness Analysis).

Indirect Impacts: Indirect impacts are expected to be generated by creating and improving water retention, increasing irrigated land and consequent increase in pumping of the fresh water table within 2 miles from the coast. A monitoring and mitigation system is recommended as part of the project to avoid potential disasters.

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Soil Erosion: The project proposes contour agriculture on sloping land, some of which is steep. WARD will attempt to influence land uses --agriculture, forestry, rangeland-- in ways that minimize erosion within acceptable soil-loss tolerances. Initially, this will be by evaluating the effects of vegetation cover using the Soil Conservation Under Agro-Forestry (SCUAF) soil loss computer model, or some equally acceptable method. Eventually, runoff plot data will be available to further guide WARD's efforts.

Because WARD will implement techniques such as hedgerow agroforestry, strip cropping using agro-sylvo-pastoral species, and contour tillage, local concentrations of runoff may occur. These concentrations could lead to rills and gully formation if downslope protection is not a component of the farming system. Downslope protection will most often be in the form of hedgerow and stripcropped species which, if implemented correctly, will have debris collecting and water spreading effect on runoff, lessening its impact. There is an upper slope limit of the effectiveness of such interventions. Beyond that limit, rangeland and forestry are more appropriate land uses than cropping.

Siltation: Bottom lands and lower watershed lands are currently susceptible to sediment accumulation resulting from high erosion rates of the upper areas. Tons of material are yearly deposited in the lower areas or dumped into the sea. One of the objectives of the project is to reduce soil material transport and siltation to improve lower lands as well as the higher lands. WARD expects that proper implementation of project activities will significantly reduce sedimentation.

Salinization: Irrigation based on ground water pumping, as planned in the project, might result in the rapid depletion of fresh water table and induce intrusion of underlying salt water inland especially in the fringe located within 2 miles of the sea. Four motor pumps are planned to be purchased and installed. Close monitoring should be undertaken to prevent the loss of irrigable lands through salt intrusion.

Downstream Water Users: Water retention in the upper reaches might or might not reduce amounts of water arriving to the lower basins. Control of this should be part of the monitoring system to be implemented to accompany the project activities.

Human Health: Water born diseases have been observed, but are not likely to increase substantially with creation of water retention structures. Surface water retention is temporary and limited in quantity.

Commodity Import Program: Currently the commodity import program includes the purchase of 12 vehicles and their spare parts and 12 motor-cycles and their spares parts for research and extension, 4 motor pumps and their parts for irrigation purposes, laboratory and office equipment, library and extension material, housing appliances for the technical assistants and miscellaneous. None of these commodities seem to have significant foreseeable adverse effects on the environment if properly managed and maintained.

Rehabilitation & Mitigation: Portions of the WARD project funded under PL480 generating local currency do not fall under the AID environmental procedures recommended by the regulation 22CFR216. It is recommend, however, that an Environmental follow up be undertaken for some of the activities planned in the project. Those activities which could have adverse effects on the environment in addition to the positive ones they are designed for are: damming for water retention, irrigation and land leveling. This would be in the form of a monitoring system that thoroughly and continuously assesses environmental changes related to project activities. The reason to set up a monitoring system from the very beginning of project implementation is to guarantee the success of the investments, and to guarantee the safety and security of the farmers. A failure of a dam, water born diseases development or soil salinization could lead to the reverse of what was expected from the WARD project and cause problems to farmers than before.

5.0 *RECOMMENDED ENVIRONMENTAL ACTION*

Agroforestry and sylvopastoral development are recommended for categorical exclusion under 216.2(c)(2)(iii) for the study component; under 216.2(c)(2)(ii) for the technology packages development; and under 216.2(c)(2)(i) for the extension and training component.

The institution building and reform assistance to DGCSAFER and INIA component of the project is recommended for categorical exclusion under 22 CFR 216.2 section (c)(2)(xiv). The technical assistance component of the program is recommended for categorical exclusion pursuant to 22 CFR 216.2 (c)(2)(i) since it is management, monitoring, planning, and advising; and suitable

environmental sensitization can be included in the job descriptions of the advisors. Technical assistance is needed for research, training, design, studies, extension services, logistical support, commodity procurement, analyses, and monitoring of conditions precedent as well as for the design and implementation of local awareness campaigns.

The training component is recommended for categorical exclusion under regulation 22 CFR 216.2 section (c)(2)(i), but offers a unique opportunity to result in a positive environmental influence. Environmental sensitisation training can be designed into training programs and be provided to researchers, extensionists, workers, and farmers, at all levels of the government including the education system.

The applied research component for agriculture and forestry is recommended for a categorical exclusion under 216.2 (c)(1)(iii) or 216.2 (c)(2)(iii) because the experiments will be of limited scope, confined to small areas, carefully controlled, and effectively monitored.

The commodity import program is recommended for categorical exclusion under 22 CFR 216.2 section (c)(2)(xii). The importation of a limited number of vehicles, spare parts, office equipment, motor pumps, computers and other commodities are not foreseen to have significant impact upon the environment. However, effects of motor pumps on water table should be carefully monitored to prevent any unforeseeable risk in loss of agricultural lands through salt intrusion.

The Title II food assistance portion of this project is recommended for categorical exclusion under regulation 22 CFR 216.2 section (c)(2)(xi). The local currency account generated from the sales of these food commodities lies outside the preview of Regulation 16. It is these monies which will finance Work-Front work programs in the watersheds.

If project funds were involved, instead of local currency, in on-farm and off-farm soil and water conservation, as well as in irrigable land development, all activities involving damming, water retention structures, water table pumping with motor pumps and land leveling/terracing, an Environmental Assessment (EA) would be required although WARD is designed to improve rapidly

degrading environmental and natural conditions. Since these activities are funded through generated local currencies, they do not fall within the purview of Regulation 16. However, the IEE preparer suggests that an environmental follow up of the project activities be carried out simultaneously with the project implementation in the form of a monitoring/mitigation system to minimize possible adverse effects and guarantee the safety and security of the rural poor. An error under the Cape Verdean fragile ecosystems could lead to disaster.

While not currently contemplated, if the commodity imports include pesticides they will be subject to review pursuant to 22 CFR 216.3(b) and will require clearance before importation and use. A covenant is necessary to prohibit use of project funds or local currency for the purchase or importation of pesticides.

ANNEX E

MINISTÉRIO DOS NEGÓCIOS ESTRANGEIROS

DIRECÇÃO-GERAL DA COOPERAÇÃO INTERNACIONAL

Telefones 61 16 24/61 15 42
Telex 6037 MPC CV

C. P. 217 — PRAIA
CABO VERDE

Endereço telegráfico
COOPERAÇÃO — PRAIA

Praia, 16 de Agosto de 1991

URGENTE

C/ 2357/91

Exmo. Senhor,

No passado, através da cooperação entre os nossos dois Países, foram empreendidos vários projectos que tinham a finalidade comum de criar condições ao desenvolvimento do potencial agrícola de Cabo Verde. Esses projectos foram nomeadamente o de Desenvolvimento das bacias hidrográficas (655 - 0013) associado ao fornecimento de uma ajuda alimentar e, o de Pesquisa Agrícola (655 - 0011).

A necessidade sentida e partilhada por ambas as Partes conduziu sucessivamente à apresentação da ideia e sua discussão e preparação (PID), assim como, à formulação de um projecto visando desta feita aproveitar e vulgarizar os resultados da pesquisa aplicando-os ao desenvolvimento das bacias. Assim nasceu o VARD, cujo documento de projecto (projet paper) acabou de ser formulado.

É nesta base que, pela presente, tenho a honra de formular oficialmente, o pedido do Governo de Cabo Verde, visando o financiamento desse novo projecto pelo Governo dos E.U.A.

Aguardando uma resposta, queira aceitar Exmo. Senhor os protestos da minha elevada consideração.

Director Geral

(illegible)

EXMO. SENHOR
THOMAS LUCHE
REPRESENTANTE DA AID
PRAIA

(INFORMAL TRANSLATION ATTACHED)

8/20/91

INFORMAL TRANSLATION

In past cooperation between our two countries, we have undertaken various projects, the common goals of which were to create conditions for the development of agriculture in Cape Verde. These projects are namely Watershed Development (655-0013) associated with food aid supply and Food Crop Research (655-0011).

The shared needs expressed by both Parties led to the idea, discussion and PID for a Project which would use and divulge research results in the development of Watersheds. Thus, WARD, the Project Paper of which has just been completed, was born.

Based on the above, I am pleased to officially request, on behalf of the Government of Cape Verde, financing for this new U.S. project.

While awaiting your response, please accept my highest regards.

Director General of Int'l Cooperation

Jose Luis Rocha

ANNEX F

STATUTORY CHECKLIST

SC(1) - COUNTRY CHECKLIST

Listed below are statutory criteria applicable to the eligibility of countries to receive the following categories of assistance: (A) both Development Assistance and Economic Support Funds; (B) Development Assistance funds only; or (C) Economic Support Funds only.

A. COUNTRY ELIGIBILITY CRITERIA APPLICABLE TO BOTH DEVELOPMENT ASSISTANCE AND ECONOMIC SUPPORT FUND ASSISTANCE

1. Narcotics

a. Negative certification (FY 1991 Appropriations Act Sec. 55v(b)): Has the President certified to the Congress that the government of the recipient country is failing to take adequate measures to prevent narcotic drugs or other controlled substances which are cultivated, produced or processed illicitly, in whole or in part, in such country or transported through such country, from being sold illegally within the jurisdiction of such country to United States Government personnel or their dependents or from entering the United States unlawfully? — No

b. Positive certification (FAA Sec. 481(h)). (This provision applies to assistance of any kind provided by grant, sale, loan, lease, credit, guaranty, or insurance, except assistance from the Child Survival Fund or relating to international narcotics control, disaster and refugee relief, narcotics education and awareness, or the provision of food or medicine.) If the recipient is a "major illicit drug producing country" (defined as a country producing during a fiscal year at least five metric tons of opium or 500 metric tons of coca or marijuana) or a "major drug-transit country" (defined as a country that is a significant direct — N/A

source of illicit drugs significantly affecting the United States, through which such drugs are transported, or through which significant sums of drug-related profits are laundered with the knowledge or complicity of the government):

(1) does the country have in place a bilateral narcotics agreement with the United States, or a multilateral narcotics agreement?

(2) has the President in the March 1 International Narcotics Control Strategy Report (INSCR) determined and certified to the Congress (without Congressional enactment, within 45 days of continuous session, of a resolution disapproving such a certification), or has the President determined and certified to the Congress on any other date (with enactment by Congress of a resolution approving such certification), that (a) during the previous year the country has cooperated fully with the United States or taken adequate steps on its own to satisfy the goals agreed to in a bilateral narcotics agreement with the United States or in a multilateral agreement, to prevent illicit drugs produced or processed in or transported through such country from being transported into the United States, to prevent and punish drug profit laundering in the country, and to prevent and punish bribery and other forms of public corruption which facilitate production or shipment of illicit drugs or discourage prosecution of such acts, or that (b) the vital national interests of the United States require the provision of such assistance?

c. Government Policy (1986 Anti-Drug Abuse Act of 1986 Sec. 2013(b)). (This section applies to the same categories of assistance subject to the restrictions in FAA Sec. 481(h), above.) If recipient country is a "major illicit drug producing country" or "major drug-transit country" (as defined for the purpose of FAA Sec 481(h)), has the President submitted a report to Congress N/A

listing such country as one: (a) which, as a matter of government policy, encourages or facilitates the production or distribution of illicit drugs; (b) in which any senior official of the government engages in, encourages, or facilitates the production or distribution of illegal drugs; (c) in which any member of a U.S. Government agency has suffered or been threatened with violence inflicted by or with the complicity of any government officer; or (d) which fails to provide reasonable cooperation to lawful activities of U.S. drug enforcement agents, unless the President has provided the required certification to Congress pertaining to U.S. national interests and the drug control and criminal prosecution efforts of that country?

2. Indebtedness to U.S. citizens (FAA Sec. 620(c): If assistance is to a government, is the government indebted to any U.S. citizen for goods or services furnished or ordered where: (a) such citizen has exhausted available legal remedies, (b) the debt is not denied or contested by such government, or (c) the indebtedness arises under an unconditional guaranty of payment given by such government or controlled entity? No

3. Seizure of U.S. Property (FAA Sec. 620(a)(1)): If assistance is to a government, has it (including any government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? No

4. Communist countries (FAA Secs. 620(a), 620(f), 620D; FY 1991 Appropriations Act Secs. 512, 545): Is recipient country a Communist country? If so, has the President: (a) determined that assistance to the country is vital to the security of the United States, that the recipient country is not controlled by N/A

the international communist conspiracy, and that such assistance will further promote the independence of the recipient country from international communism, or (b) removed a country from applicable restrictions on assistance to communist countries upon a determination and report to Congress that such action is important to the national interest of the United States? Will assistance be provided either directly or indirectly to Angola, Cambodia, Cuba, Iraq, Libya, Vietnam, Iran or Syria? Will assistance be provided to Afghanistan without a certification, or will assistance be provided inside Afghanistan through the Soviet-controlled government of Afghanistan?

5. Mob Action (FAA Sec. 620(j)): Has the country permitted, or failed to take adequate measures to prevent, damage or destruction by mob action of U.S. property? — No

6. OPIC Investment Guaranty (FAA Sec. 620(l)): Has the country failed to enter into an investment guaranty agreement with OPIC? — No

7. Seizure of U.S. Fishing Vessels (FAA Sec. 620(o); Fishermen's Protective Act of 1967 (as amended) Sec. 5): (a) Has the country seized, or imposed any penalty or sanction against, any U.S. fishing vessel because of fishing activities in international waters? (b) If so, has any deduction required by the Fishermen's Protective Act been made? — No

8. Loan Default (FAA Sec. 620(q); FY 1991 Appropriations Act Sec. 518 (Brooke Amendment)): (a) Has the government of the recipient country been in default for more than six months on interest or principal of any loan to the country under the FAA? (b) Has the country been in default for more than one year on interest or principal on any U.S. loan under a program for which the FY 1990 Appropriations Act appropriates funds? — No

9. Military Equipment (FAA Sec. 620(s)): If contemplated assistance is development loan or to come from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget and amount of the country's foreign exchange or other resources spent on military equipment? (Reference may be made to the annual "Taking Into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

N/A

10. Diplomatic Relations with U.S. (FAA Sec. 620(t)): Has the country severed diplomatic relations with the United States? If so, have relations been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?

No

11. U.N. Obligations (FAA Sec. 620(u)): What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the A.I.D. Administrator in determining the current A.I.D. Operational Year Budget? (Reference may be made to the "Taking into Consideration" memo.)

- As of June 30, 1991, payment of Cape Verde's obligations to the U.N. was in arrears by $ 153,800. These arrearages were taken into account by the A.I.D. Administrator in determining the current operational year Budget.

12. International Terrorism

a. Sanctuary and support (FY 1991 Appropriations Act Sec. 556; FAA Sec. 620A): Has the country been determined by the President to: (a) grant sanctuary from prosecution to any individual or group which has committed an act of international terrorism, or (b) otherwise support international terrorism, unless the President has waived this restriction on grounds of national security or for humanitarian reasons?

No

h. Airport Security (ISDCA of 1985 Sec. 552(b). Has the Secretary of State determined that the country is a high terrorist threat country after the Secretary of Transportation has determined, pursuant to section 1115(e)(2) of the Federal Aviation Act of 1958, that an airport in the country does not maintain and administer effective security measures? — No

13. Discrimination (FAA Sec. 666(b)): Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who is present in such country to carry out economic development programs under the FAA? — No

14. Nuclear Technology (FAA Secs. 669, 670): Has the country, after August 3, 1977, delivered to any other country or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards, and without special certification by the President? Has it transferred a nuclear explosive device to a non-nuclear weapon state, or if such a state, either received or detonated a nuclear explosive device? If the country is a non-nuclear weapon state, has it, on or after August 8, 1985, exported (or attempted to export) illegally from the United States any material, equipment, or technology which would contribute significantly to the ability of a country to manufacture a nuclear explosive device? (FAA Sec. 620E permits a special waiver of Sec. 669 for Pakistan.) — No

15. Algiers Meeting (ISDCA of 1981, Sec. 720): Was the country represented at the Meeting of Ministers of Foreign Affairs and Heads of Delegations of the Non-Aligned Countries to the 36th General Assembly of the U.N. on Sept. 25 and 28, 1981, and did it fail to disassociate itself from the communique issued? If so, has the President taken it into account? (Reference may be made to the "Taking into Consideration" memo.) — Cape Verde has not yet entered written reservations and this matter was taken into account by the A.I.D. Administrator in determining the current A.I.D. Operational Year Budget.

16. Military Coup (FY 1991 Appropriations Act Sec. 513): Has the duly elected Head of Government of the country been deposed by military coup or decree? If assistance has been terminated, has the President notified Congress that a democratically elected government has taken office prior to the resumption of assistance? — No

17. Refugee Cooperation (FY 1991 Appropriations Act Sec. 539): Does the recipient country fully cooperate with the international refugee assistance organizations, the United States, and other governments in facilitating lasting solutions to refugee situations, including resettlement without respect to race, sex, religion, or national origin? — Yes

18. Exploitation of Children (FY 1991 Appropriations Act Sec. 599D, amending FAA Sec. 116): Does the recipient government fail to take appropriate and adequate measures, within its means, to protect children from exploitation, abuse or forced conscription into military or paramilitary services? — Yes

B. COUNTRY ELIGIBILITY CRITERIA APPLICABLE ONLY TO DEVELOPMENT ASSISTANCE ("DA")

1. Human Rights Violations (FAA Sec. 116): Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy? — No

2. Abortions (FY 1991 Appropriations Act Sec. 535): Has the President certified that use of DA funds by this country would violate any of the prohibitions against use of funds to pay for the performance of abortions as a method of family planning, to motivate or coerce any person to practice abortions, to pay for the performance of involuntary — No

sterilization as a method of family planning, to coerce or provide any financial incentive to any person to undergo sterilizations, to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning?

C. COUNTRY ELIGIBILITY CRITERIA APPLICABLE ONLY TO ECONOMIC SUPPORT FUNDS ("ESF") N/A

Human Rights Violations (FAA Sec. 620A). Has it been determined that the country has engaged in a sensibleml. pattern or gross violations of internationally recognized human rights? If so, has the President found that the country made such significant improvement in its human rights record that furnishing such assistance is in the U.S. national interest?

SC(2) - ASSISTANCE CHECKLIST

Listed below are statutory criteria applicable to the assistance resources themselves, rather than to the eligibility of a country to receive assistance. This section is divided into three parts. Part A includes criteria applicable to both Development Assistance and Economic Support Fund resources, Part B includes criteria applicable only to Development Assistance resources. Part C includes criteria applicable only to Economic Support Funds.

CROSS REFERENCE: IS COUNTRY CHECKLIST UP TO DATE?

A. CRITERIA APPLICABLE TO BOTH DEVELOPMENT ASSISTANCE AND ECONOMIC SUPPORT FUNDS

1. Host Country Development Efforts (FAA Sec. 601(a)): Information and conclusions on whether assistance will encourage efforts of the country to:	No
(a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations;	Yes No
(d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.	No Yes (e) No
2. U.S. Private Trade and Investment (FAA Sec. 601(b)): Information and conclusions on how assistance will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Will not directly affect U.S. Private Trade and investment. Will encourage participation of U.S. UNiversities, agriculture specialists, and PVO's in foreign assistance

3. Congressional Notification

a. General requirement (FY 1991 Appropriations Act Secs. 523 and 591; FAA Sec. 634A): If money is to be obligated for an activity not previously justified to Congress, or for an amount in excess of amount previously justified to Congress, has Congress been properly notified (unless the notification requirement has been waived because of substantial risk to human health or welfare)?

No. Congress will be appropriately notified before funds are obligated.

b. Notice of new account obligation (FY 1991 Appropriations Act Sec. 514): If funds are being obligated under an appropriation account to which they were not appropriated, has the President consulted with and provided a written justification to the House and Senate Appropriations Committees and has such obligation been subject to regular notification procedures?

N/A

c. Cash transfers and nonproject sector assistance (FY 1991 Appropriations Act Sec. 575(b)(3)): If funds are to be made available in the form of cash transfer or nonproject sector assistance, has the Congressional notice included a detailed description of how the funds will be used, with a discussion of U.S. interests to be served and a description of any economic poolicy reforms to be promoted?

N/a

4. Engineering and Financial Plans (FAA Sec. 611(a)): Prior to an obligation in excess of $500,000, will there be: (a) engineering, financial or other plans necessary to carry out the assistance; and (b) a reasonably firm estimate or the cost to the U.S. of the assistance?

Yes

5. Legislative Action (FAA Sec. 611(a)(2)): If legislative action is required within recipient country with respect to an obligation in excess of $500,000, what is the basis for a reasonable expectation that such action

N/A

will be completed in time to permit orderly accomplishment of the purpose of the assistance?

6. Water Resources (FAA Sec. 611(b); FY 1991 Appropriations Act Sec. 501): If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable in accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See A.I.D. Handbook 3 for guidelines.) — Yes

7. Cash Transfer and Sector Assistance (FY 1991 Appropriations Act Sec. 575(b)): Will cash transfer or nonproject sector assistance be maintained in a separate account and not commingled with other funds (unless such requirements are waived by Congressional notice for nonproject sector assistance)? — N/A

8. Capital Assistance (FAA Sec. 611(e)): If project is capital assistance (e.g., construction), and total U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability to maintain and utilize the project effectively? — N/A

9. Multiple Country Objectives (FAA Sec. 601(a)): Information and conclusions on whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

(a)	No
(b)	Yes
(c)	No
(d)	No
(e)	Yes
(f)	No

10. **U.S. Private Trade (FAA Sec. 601(b)):** Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

Will not directly affect U.S. Private Trade and Investment. Will encourage participation of U.S. Universities, agriculture specialists, and PVO'S in foreign Assistance

11. Local Currencies

a. **Recipient Contributions (FAA Secs. 612(b), 636(h)):** Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.

The Government of Cape Verde will fundwith its own resources the salaries and benefits or counterparties at INIA, as well as office space for U.S. technical professionals. Foreign currency generated through a monetized P.L. 480 Title II Program will fund ancillary research costs, on-farm trials and complementary construction and maintenance of watershed structures to increase sustainability of agriculture.

b. **U.S.-Owned Currency (FAA Sec. 612(d)):** Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?

B. - No

c. **Separate Account (FY 1991 Appropriations Act Sec. 575).** If assistance is furnished to a foreign government under arrangements which result in the generation of local currencies:

C - N/A

(1) Has A.I.D. (a) required that local currencies be deposited in a separate account established by the recipient government, (b) entered into an agreement with that government providing the amount of local currencies to be generated and the terms and conditions under which the currencies so deposited may be utilized, and (c) established by agreement the responsibilities of A.I.D. and that government to monitor and account for deposits into and disbursements from the seperate account?

(3) Will such local currencies, or an equivalent amount of local currencies, be used only to carry out the purposes of the DA or ESF chapters of the FAA (depending on which chapter is the source of the assistance) or for the administrative requirements of the United States Government?

(3) Has A.I.D. taken all appropriate steps to ensure that the equivalent of local currencies disbursed from the separate account are used for the agreed purposes?

(4) If assistance is terminated to a country, will any unencumbered balances of funds remaining in a separate account be disposed of for purposes agreed to by the recipient government and the United States Government?

12. Trade Restrictions

a. Surplus Commodities (FY 1991 Appropriations Act Sec. 521(a)): If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity? N/A

b. Textiles (Lautenberg Amendment) (FY 1991 Appropriations Act Sec. 521(c)): Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U.S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of facilities specifically designed for, the manufacture for export to the United States or to third country markets in direct competition with U.S. exports, of N/A

textiles, apparel, footwear, handbags, flat goods (such as wallets or coin purses worn on the person), work gloves or leather wearing apparel?

13. Tropical Forests (FY 1991 Appropriations Act Sec. 533(c)(7)): Will funds be used for any program, project or activity which would (a) result in any significant loss of tropical forests, or (b) involve industrial timber extraction in primary tropical forest areas?

No

14. PVO Assistance

a. Auditing and registration (FY 1991 Appropriations Act Sec. 537): If assistance is being made available to a PVO, has that organization provided upon timely request any document, file, or record necessary to the auditing requirements of A.I.D., and is the PVO registered with A.I.D.?

If a PVO is selected to implement any part of the project, these requirements will be complied with before any grant or collaborative agreement is entered into by A.I.D.

b. Funding sources (FY 1991 Appropriations Act, Title II, under heading "Private and Voluntary Organizations"): If assistance is to be made to a United States PVO (other than a cooperative development organization), does it obtain at least 20 percent of its total annual funding for international activities from sources other than the United States Government?

This will be a condition of any agreement entered into by A.I.D.

15. Project Agreement Documentation (State Authorization Sec. 139 (as interpreted by conference report)): Has confirmation of the date of signing of the project agreement, including the amount involved, been cabled to State L/T and A.I.D. LEG within 60 days of the agreement's entry into force with respect to the United States, and has the full text of the agreement been pouched to those same offices? (See Handbook 3, Appendix 6G for agreements covered by this provision).

This requirement will be complied with

16. **Metric System** (Omnibus Trade and Competitiveness Act of 1988 Sec. 5164, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy): Does the assistance activity use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage?	Yes
17. Women in Development (FY 1991 Appropriations Act, Title II, under heading "Women in Development"): Will assistance be designed so that the percentage of women participants will be demonstrably increased?	No - Women are already the predominant participants in the agriculture sector
18. **Regional and Multilateral Assistance** (FAA Sec. 205): Is assistance more efficiently and effectively provided through regional or multilateral organizations? If so, why is assistance not so provided? Information and conclusions on whether assistance will encourage developing countries to cooperate in regional development programs.	No - through this project every effort will be made to enhance donor coordination in agriculture research and watershed management

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19. Abortions (FY 1991 Appropriations Act, Title II, under heading "Population, DA," and Sec. 525):

a. Will assistance be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization? — No

b. Will any funds be used to lobby for abortion? — No

20. Cooperatives (FAA Sec. 111): Will assistance help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life? — No

21. U.S.-Owned Foreign Currencies

a. Use of currencies (FAA Secs. 612(b), 636(h); FY 1991 Appropriations Act Secs. 507, 509): Describe steps taken to assure that, to the maximum extent possible, foreign currencies owned by the U.S. are utilized in lieu of dollars to meet the cost of contractual and other services. — N/A

b. Release of currencies (FAA Sec. 612(d)): Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release? — No

22. Procurement

a. Small business (FAA Sec. 602(a)): Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed? — Yes

b. U.S. procurement (FAA Sec. 604(a)): Will all procurement be from the U.S. except as otherwise determined by the President or determined under delegation from him? — No - under DFA procurement code will be 935. However, every effort will be made to encourage U.S. procurement

c. Marine insurance (FAA Sec. 604(d)): If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company? N/A

d. Non-U.S. agricultural procurement (FAA Sec. 604(e)): If non-U.S. procurement of agricultural commodity or product thereof is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.) N/A

e. Construction or engineering services (FAA Sec. 604(g)): Will construction or engineering services be procured from firms of advanced developing countries which are otherwise eligible under Code 941 and which have attained a competitive capability in international markets in one of these areas? (Exception for those countries which receive direct economic assistance under the FAA and permit United States firms to compete for construction or engineering services financed from assistance programs of these countries.) No

f. Cargo preference shipping (FAA Sec. 603)): Is the shipping excluded from compliance with the requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 percent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates? No

g. Technical assistance (FAA Sec. 621(a)): If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? Will the Yes

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facilities and resources of other Federal agencies be utilized, when they are particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

h. U.S. air carriers (International Air Transportation Fair Competitive Practices Act, 1974): If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? — Yes

i. Termination for convenience of U.S. Government (FY 1991 Appropriations Act Sec. 504): If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? — Yes

j. Consulting services (FY 1991 Appropriations Act Sec. 524): If assistance is for consulting service through procurement contract pursuant to 5 U.S.C. 3109, are contract expenditures a matter of public record and available for public inspection (unless otherwise provided by law or Executive order)? — For contracts entered into, contract expenditures will be a matter of public record and available for inspection.

k. Metric conversion (Omnibus Trade and Competitiveness Act of 1988, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy): Does the assistance program use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest — Yes

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documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage?

1. Competitive Selection Procedures (FAA Sec. 601(e)): Will the assistance utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? — Yes

23. Construction

a. Capital project (FAA Sec. 601(d)): If capital (e.g., construction) project, will U.S. engineering and professional services be used? — N/A

b. Construction contract (FAA Sec. 611(c)): If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? — N/A

c. Large projects, Congressional approval (FAA Sec. 620(k)): If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the Congressional Presentation), or does assistance have the express approval of Congress? — N/A

24. U.S. Audit Rights (FAA Sec. 301(d)): If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? — N/A

25. Communist Assistance (FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? — Yes

26. Narcotics

a. Cash reimbursements (FAA Sec. 483): Will arrangements preclude use of financing to make reimbursements, in the form of cash payments, to persons whose illicit drug crops are eradicated? N/A

b. Assistance to narcotics traffickers (FAA Sec. 487): Will arrangements take "all reasonable steps" to preclude use of financing to or through individuals or entities which we know or have reason to believe have either: (1) been convicted of a violation of any law or regulation of the United States or a foreign country relating to narcotics (or other controlled substances); or (2) been an illicit trafficker in, or otherwise involved in the illicit trafficking of, any such controlled substance? Yes

27. Expropriation and Land Reform (FAA Sec. 620(g)): Will assistance preclude use of financing to compensate owners for expropriated or nationalized property, except to compensate foreign nationals in accordance with a land reform program certified by the President? Yes

28. Police and Prisons (FAA Sec. 660): Will assistance preclude use of financing to provide training, advice, or any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? Yes

29. CIA Activities (FAA Sec. 662): Will assistance preclude use of financing for CIA activities? Yes

30. Motor Vehicles (FAA Sec. 636(i)): Will assistance preclude use of financing for purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? Yes

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31. Military Personnel (FY 1991 Appropriations Act Sec. 503): Will assistance preclude use of financing to pay pensions, annuities, retirement pay, or adjusted service compensation for prior or current military personnel? — Yes

32. Payment of U.N. Assessments (FY 1991 Appropriations Act Sec. 505): Will assistance preclude use of financing to pay U.N. assessments, arrearages or dues? — Yes

33. Multilateral Organization Lending (FY 1991 Appropriations Act Sec. 506) Will assistance preclude use of financing to carry out provisions of FAA section 209(d) (transfer of FAA funds to multilateral organizations for lending)? — Yes

34. Export of Nuclear Resources (FY 1991 Appropriations Act Sec. 510): Will assistance preclude use of financing to finance the export of nuclear equipment, fuel, or technology? — Yes

35. Repression of Population (FY 1991 Appropriations Act Sec. 511): Will assistance preclude use of financing for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? — Yes

36. Publicity or Propoganda (FY 1991 Appropriations Act Sec. 516): Will assistance be used for publicity or propaganda purposes designed to support or defeat legislation pending before Congress, to influence in any way the outcome of a political election in the United States, or for any publicity or propaganda purposes not authorized by Congress? — No

37. Marine Insurance (FY 1991 Appropriations Act Sec. 563): Will any A.I.D. contract and solicitation, and subcontract entered into under such contract, include a clause requiring that U.S. marine insurance companies have a fair opportunity to bid for marine insurance when such insurance is necessary or appropriate? Yes

38. Exchange for Prohibited Act (FY 1991 Appropriations Act Sec. 569): Will any assistance be provided to any foreign government (including any instrumentality or agency thereof), foreign person, or United States person in exchange for that foreign government or person undertaking any action which is, if carried out by the United States Government, a United States official or employee, expressly prohibited by a provision of United States law? NO

B. CRITERIA APPLICABLE TO DEVELOPMENT ASSISTANCE ONLY

1. Agricultural Exports (Bumpers Amendment) (FY 1991 Appropriations Act Sec. 521(b), as interpreted by conference report for original enactment): If assistance is for agricultural development activities (specifically, any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference, or training), are such activities: (1) specifically and principally designed to increase agricultural exports by the host country to a country other than the United States, where the export would lead to direct competition in that third country with exports of a similar commodity grown or produced in the United States, and can the activities reasonably be expected to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (2) in support of research that is intended primarily to benefit U.S. producers? No

2. Tied Aid Credits (FY 1991 Appropriations Act, Title II, under heading "Economic Support Fund"): Will DA funds be used for tied aid credits?	No
3. Appropriate Technology (FAA Sec. 107): Is special emphasis placed on use of appropriate technology (defined as relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	Yes
4. Indigenous Needs and Resources (FAA Sec. 281(b)): Describe extent to which the activity recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.	These issues are described in the project paper
5. Economic Development (FAA Sec. 101(a)): Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes
6. Special Development Emphases (FAA Secs. 102(b), 113, 281(a)): Describe extent to which activity will: (a) effectively involve the poor in development by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, dispersing investment from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using appropriate U.S. institutions; (b) encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries	These issues are described in the project paper

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and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries.

7. Recipient Country Contribution (FAA Secs. 110, 124(d)): Will the recipient country provide at least 25 percent of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)? Yes

8. Benefit to Poor Majority (FAA Sec. 128(b)): If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority? Yes

9. Abortions (FAA Sec. 104(f); FY 1991 Appropriations Act, Title II, under heading "Population, DA," and Sec. 535):

a. Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions? NO

b. Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilizations? No

c. Are any of the funds to be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization? NO

d. Will funds be made available only to voluntary family planning projects which offer, either directly or through referral to, or information about access to, a broad range of family planning methods and services? — N/A

e. In awarding grants for natural family planning, will any applicant be discriminated against because of such applicant's religious or conscientious commitment to offer only natural family planning? — N/A

f. Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning? — No

g. Are any of the funds to be made available to any organization if the President certifies that the use of these funds by such organization would violate any of the above provisions related to abortions and involuntary sterilization? — No

10. Contract Awards (FAA Sec. 601(e)): Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? — Yes

11. Disadvantaged Enterprises (FY 1991 Appropriations Act Sec. 567): What portion of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, colleges and universities having a student body in which more than 40 percent of the students are Hispanic Americans, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?

Project will comply with Gray Amendment. 8(A) firms and HBCU's will be encouraged to apply. For all contracts over $500,000, not less than 10% of the contract sum will be subcontracted to 8(a) firms and/or HBCU's

12. **Biological Diversity (FAA Sec. 119(g)**: Will the assistance: (a) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity; (b) be provided under a long-term agreement in which the recipient country agrees to protect ecosystems or other wildlife habitats; (c) support efforts to identify and survey ecosystems in recipient countries worthy of protection; or (d) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas?

No

NO

Yes

No

13. Tropical Forests (FAA Sec. 118; FY 1991 Appropriations Act Sec. 533(c)-(e) & (g)):

a. A.I.D. Regulation 16: Does the assistance comply with the environmental procedures set forth in A.I.D. Regulation 16?

b. Conservation: Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (1) stress the importance of conserving and sustainably managing forest resources; (2) support activities which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and help countries identify and implement alternatives to colonizing forested areas; (3) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (4) help end destructive slash-and-burn agriculture by supporting stable and productive farming practices; (5) help conserve forests which have not yet been degraded by helping to increase production on lands already cleared or degraded; (6) conserve forested watersheds and rehabilitate those which have been deforested; (7) support training, research, and other actions

N/A. Due to arid and semi-arid conditions, Cape Verde does not possess forests typically considered tropical forests

which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (8) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (9) conserve biological diversity in forest areas by supporting efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis, by making the establishment of protected areas a condition of support for activities involving forest clearance or degradation, and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas; (10) seek to increase the awareness of U.S. Government agencies and other donors of the immediate and long-term value of tropical forests; (11) utilize the resources and abilities of all relevant U.S. government agencies; (12) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land; and (13) take full account of the environmental impacts of the proposed activities on biological diversity?

c. Forest degradation: Will assistance be used for: (1) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner and that the proposed activity will produce positive economic benefits and sustainable forest management systems; (2) actions which will significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas; (3) activities which would result in the conversion of forest lands to the rearing of livestock; (4) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undergraded

forest lands; (5) the colonization of forest lands; or (6) the construction of dams or other water control structures which flood relatively undergraded forest lands, unless with respect to each such activity an environmental assessment indicates that the activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development?

d. Sustainable forestry: If assistance relates to tropical forests, will project assist countries in developing a systematic analysis of the appropriate use of their total tropical forest resources, with the goal of developing a national program for sustainable forestry?

e. Environmental impact statements: Will funds be made available in accordance with provisions of FAA Section 117(c) and applicable A.I.D. regulations requiring an environmental impact statement for activities significantly affecting the environment?

14. Energy (FY 1991 Appropriations Act Sec. 533(c)): If assistance relates to energy, will such assistance focus on: (a) end-use energy efficiency, least-cost energy planning, and renewable energy resources, and (b) the key countries where assistance would have the greatest impact on reducing emissions from greenhouse gases? N/A

15. Sub-Saharan Africa Assistance (FY 1991 Appropriations Act Sec. 562, adding a new FAA chapter 10 (FAA Sec. 496)): If assistance will come from the Sub-Saharan Africa DA account, is it: (a) to be used to help the poor majority in Sub-Saharan Africa through a process of long-term development and economic growth that is equitable, participatory, environmentally sustainable, and self-reliant; (b) to be used to promote sustained economic growth, encourage N/A

private sector development, promote individual initiatives, and help to reduce the role of central governments in areas more appropriate for the private sector; (c) to be provided in a manner that takes into account, during the planning process, the local-level perspectives of the rural and urban poor, including women, through close consultation with African, United States and other PVOs that have demonstrated effectiveness in the promotion of local grassroots activities on behalf of long-term development in Sub-Saharan Africa; (d) to be implemented in a manner that requires local people, including women, to be closely consulted and involved, if the assistance has a local focus; (e) being used primarily to promote reform of critical sectoral economic policies, or to support the critical sector priorities of agricultural production and natural resources, health, voluntary family planning services, education, and income generating opportunities; and (f) to be provided in a manner that, if policy reforms are to be effected, contains provisions to protect vulnerable groups and the environment from possible negative consequences of the reforms?

16. Debt-for-Nature Exchange (FAA Sec. 463): If project will finance a debt-for-nature exchange, describe how the exchange will support protection of: (a) the world's oceans and atmosphere, (b) animal and plant species, and (c) parks and reserves; or describe how the exchange will promote: (d) natural resource management, (e) local conservation programs, (f) conservation training programs, (g) public commitment to conservation, (h) land and ecosystem management, and (i) regenerative approaches in farming, forestry, fishing, and watershed management. N.A

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17. Deobligation/Reobligation (FY 1991 Appropriations Act Sec. 515): If deob/reob authority is sought to be exercised in the provision of DA assistance, are the funds being obligated for the same general purpose, and for countries within the same region as originally obligated, and have the House and Senate Appropriations Committees been properly notified? N/A

18. Loans N/A

a. Repayment capacity (FAA Sec. 122(b)): Information and conclusion on capacity of the country to repay the loan at a reasonable rate of interest.

b. Long-range plans (FAA Sec. 122(b)): Does the activity give reasonable promise of assisting long range plans and programs designed to develop economic resources and increase productive capacities?

c. Interest rate (FAA Sec. 122(b)): If development loan is repayable in dollars, is interest rate at least 2 percent per annum during a grace period which is not to exceed ten years, and at least 3 percent per annum thereafter?

d. Exports to United States (FAA Sec. 620(d)): If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20 percent of the enterprise's annual production during the life of the loan, or has the requirement to enter into such an agreement been waived by the President because of a national security interest?

19. Development Objectives (FAA Secs. 102(a), 111, 113, 281(a)): Extent to which activity will: (1) effectively involve the poor in development, by expanding access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from

(1) Project focuses on sustainable agricultural production of rural poor, labor intensive farming and watershed management practices. All activities are in rural areas

(2) Does not directly assist development of cooperatives/democratic organizations

(3) Project is fully based on self-help efforts of rural poor in agriculture and watershed protection.

(4) Women are widely engaged

cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (2) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (3) support the self-help efforts of developing countries; (4) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (5) utilize and encourage regional cooperation by developing countries?

(5) Will encourage dor: coordination in agriculture and watershed protecti:

20. Agriculture, Rural Development and Nutrition, and Agricultural Research (FAA Secs. 103 and 103A):

a. Rural poor and small farmers: If assistance is being made available for agriculture, rural development or nutrition, describe extent to which activity is specifically designed to increase productivity and income of rural poor; or if assistance is being made available for agricultural research, has account been taken of the needs of small farmers, and extensive use of field testing to adapt basic research to local conditions shall be made.

Project paper addresses these issues.

b. Nutrition: Describe extent to which assistance is used in coordination with efforts carried out under FAA Section 104 (Population and Health) to help improve nutrition of the people of developing countries through encouragement of increased production of crops with greater nutritional value; improvement of planning, research, and education with respect to nutrition, particularly with reference to improvement and expanded use of indigenously produced foodstuffs; and the undertaking of pilot or demonstration programs explicitly addressing the problem of malnutrition of poor and vulnerable people.

Project will promote improved production of nutritious crops on a sustainable basis

c. Food security: Describe extent to which activity increases national food security by improving food policies and management and by strengthening national food reserves, with particular concern for the needs of the poor, through measures encouraging domestic production, building national food reserves, expanding available storage facilities, reducing post harvest food losses, and improving food distribution.

Through increasing the sustainability of agriculture the project will improve food security over the long-term.

21. Population and Health (FAA Secs. 104(b) and (c)): If assistance is being made available for population or health activities, describe extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems, and other modes of community outreach.

N/A

22. Education and Human Resources Development (FAA Sec. 105): If assistance is being made available for education, public administration, or human resource development, describe (a) extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, and strengthens management capability of institutions enabling the poor to participate in development; and (b) extent to which assistance provides advanced education and training of people of developing countries in such disciplines as are required for planning and implementation of public and private development activities.

N/A (only limited specialized agriculture training will be provided)

23. Energy, Private Voluntary Organizations, and Selected Development Activities (FAA Sec. 106): If assistance is being made available for energy, private voluntary organizations, and selected development problems, describe extent to which activity is:

N/A

a. concerned with data collection and analysis, the training of skilled personnel, research on and development of suitable energy sources, and pilot projects to test new methods of energy production; and facilitative of research on and development and use of small-scale, decentralized, renewable energy sources for rural areas, emphasizing development of energy resources which are environmentally acceptable and require minimum capital investment;

b. concerned with technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

c. research into, and evaluation of, economic development processes and techniques;

d. reconstruction after natural or manmade disaster and programs of disaster preparedness;

e. for special development problems, and to enable proper utilization of infrastructure and related projects funded with earlier U.S. assistance;

f. for urban development, especially small, labor-intensive enterprises, marketing systems for small producers, and financial or other institutions to help urban poor participate in economic and social development.

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ANNEX H

THE WATERSHED APPLIED RESEARCH AND DEVELOPMENT DESIGN TEAM

Team Leader/Agricultural Economist	Gerald P. Owens, Experience, Incorporated
Agronomist/Project Design Specialist	Richard Caldwell, Experience, Incorporated
Natural Resources/ Hydrology Specialist	Curtiss Paskett, Experience, Incorporated
Natural Resources/Forestry Specialist	John Meyer, Experience, Incorporated
Agro-anthropologist	Constance McCorkle, Experience, Incorporated
Institutional Specialist	Helder Santos, USAID/Praia
Project Design Specialist	Peter Feiden, AID/W
Environmental Specialist	Idrissa Sambu, REDSO/WCA

ANNEX I

PERSONS CONTACTED

Coutinho, Elizabeth - Responsavel pelo Departamento de Ciencias Sociais do INIA

de Laethavwer, Eddy - FAO Silviculture expert

de Pina, Alexandre - Director, Studies and Planning Cabinet, MDRP

Delgado, Manuel - Director General of Soil and Water Conservation and Rural Engineering (DGCSAFER)

Delgado, Manuel - Director-Geral de Conservacão de Solos, Florestas e Engenheiria Rural

do Rosario, Gualberto - Minister of Rural Development and Fisheries

Fonseca, Luciano - Director Geral da Extensão Rural

Freitas, Manuel - Water Engineer, UNICEF

Grabowski, John - Cape Verde Country Director, Peace Corps

Guimarães, Marcelo - FAO Forestry training expert

Lima, João - Director, Rural Engineering Services, DGCSAFER

Moniz, Carlos - Director dos Serviços Florestais

Monteiro, Pedro - Chief of Planning Division, Forest Service

Novoa, Luis - FAO Forestry production expert

Rocha, Jose Luis - Director Geral da Cooperacao

Rocha, Jose - Director General, Cooperacão

Sabino, António Alvino - Fresidente do Instituto Nacional de Investigacão Agraria (INIA)

Silva, Amadeu - Former Director, RAP

Silva, Carlos - Director of Research, INIA

Soares, Luis - Chief, Renewable Energy Division

ANNEX J

SUPPORTING TABLES

Table 1. Other Activities Related to Natural Resource Conservation and Agricultural Development in Cape Verde

SANTIAGO ISLAND		
DONOR	ACTIVITY	LOCATION
UNSO/UNDP	Soil/Water Conservation	Sao Joao Baptista
Swissaid	Soil/Water Conservation	Praia Formosa
FAO/Belgium	Reforestation	Santiago, Maio
Local Funding	Reforestation	Santa Catarina Tarrafal Santa Cruz
IFAD	Rainfed agr./Livestock	Santa Cruz
NOVIB (PVO)	Livestock (goats)	Arid Zones
Swissaid	Rural Extension	Rebeira Seca
CILSS/EEC	Regional Solar Power	All Islands
UNDP/DTCE	Water Development	JRH
EEC	water wells	Island-wide
UNICEF	Rural Water Supply	Santiago/S. Antão
FAO/Belgium	Livestock Development	Santiago
FAO/Dutch	Seed Production	Santiago
National	Locust Control	All Islands
CILSS/EEC/Italy	Agricultural Statistics	All Islands

Table 1. (continued)

SANTIAGO ISLAND		
DONOR	ACTIVITY	LOCATION
EEC/FAO-Belg	Aerial Reconnaisance	All Islands
Dutch	Alternative Energy	All Islands
AGRHYMET	Meteorology	All Islands
CILSS/EEC	Reforestation	Santiago/S. Antão/ S. Nicolau
FAO/Italy	Training Center Support	São Jorge
Japan	Agricultural Inputs	All Islands
ADB	Agricultural Credit	All Islands
CILSS/EEC	Seed Improvement for Corn, Beans, and Sorghum	São Jorge
FAO	Food Quality Control	Praia
Portugal	Coffee Seed Production	Santiago

TABLE 2: Proposed Recurring and Regular Short-Term TA	
Position	LOE (pms)
Recurring	
Agroforester	5.5
Range/Livestock Specialist	4.5
Private Enterprise Specialist	4
Fruit Production Specialist	4.5
Hydrologist (Monitoring)	9
Watershed Agronomist	3
Soil Erosion Specialist	5
Irrigation Specialist	10
Extension Specialist	8
Research Planner	5
Farming Systems Researcher	4
Regular Short-Term	
Training Specialist	1.5
Tree Seed Specialist	1.5
Tree Legume Specialist	1.5
Forage Specialist	2
Animal Nutritionist	2
Hydrometeorologist	[illegible]
Civil/Agricultural Engineer	1.5
Land-Use Planner	1.5
Statistician	2
Computer Specialist	2
Soils Specialist (Laboratory)	2
Agricultural Training Specialist	3
MIS Specialist	1

TABLE 3: Proposed Long-Term Training

Training Topic	Degree	LOE (pys)
U.S.A		
Irrigation Management	M.Sc.	2.5
Agronomy	M.Sc.	2.5
Agricultural Economics	B.Sc.	4.5
Watershed Hydrology	M.Sc.	2.5
Agroforestry (2)	M.Sc.	5.0
Range Management	B.Sc.	4.5
Civil Engineering	M.Sc.	2.5
Watershed Management	B.Sc.	4.5
In-Country		
Technician/Extension	-	60
Technician/Forestry	-	18

TABLE 4: Proposed Short-Term Training

Training Topic	LOE (pms)
U.S.A	
Monitoring and Evaluation	3
Extension Methods	4
Technical Training	15
Computer Training	3
Agroforestry Methods	4.5
Small-Scale Water Management	5
Third Country	
Research Management/Administration	2
Irrigation Management	6
Soils workshops	4
In-Country	
Farming Systems Research Methodology	20
Socioeconomics Field Methods	6
On-Farm Research	30
Experimental Design/Statistics	15
Proposal Writing	15
Field Preparation	10
Farmer Orientation	80
Research for Sustainable Production	10
Research/Extension Linkages	20
Business Management	2
Computer/Statistics	20
Training of Trainers	10
Extension Methods	15
Sylvicultural Techniques	24
Agroforestry	20
Community Forestry	12
Fruit Tree Grafting	9
Fruit Production & Marketing	10
Small Enterprise Management	15
Hydrometeorology	1.5
Structural Evaluation	1.5
Soil Erosion Research	5
Management Systems	5

ILLUSTRATIVE PROCUREMENT PLAN
000 dollars

ITEM	EXT-ENSION	RESEARCH	SOIL & WATER CONSER-VATION	FORESTRY	PROJECT ADMIN-ISTRATION	TOTAL
Vehicles, Motos, Spares	34	98	96	76	88	392
Laboratory equipment		10				10
Office supplies/equipt.	4	18		49	20	91
Visual aids	2					2
Construction material			67			67
Tools			22	12		34
Instruments			17	6		23
Planting sacs				45		45
Miscellaneous	28	20		25	15	88
TOTAL	68	146	202	213	123	752

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ANNEX K

This annex describes how the WARD Project Paper has addressed the main issues raised during the PID review in REDSO/WCA and AID/W.

WARD PID ISSUES FROM REDSO/WCA (90 ABIDJAN 22205, 10/17/90)

1. Project Definition - is the project (1) a humanitarian aid program with significant ancillary development impact, or (2) a development project with a secondary objective of employment generation?

Response: the WARD Project is designed as a development project, building on the impacts and lessons learned from the Watershed Development Project and the Food Crops Research Project. The project is to be implemented by a cooperative agreement with a USPVO having a demonstrated capacity in watershed management and agriculture, and a university, with a demonstrated capacity in agricultural research and extension. The PL 480 inputs are to be provided by the GOCV, under a 100% Title II monetization program to be carried out by a USPVO.

2. Project Sustainability: can watershed development activities being carried out under the WARD project be continued by the GOCV and/or communities once this project is over, especially because of the heavy subsidization through use of PL 480 local currency generations for employment generation?

Response: The economy of Cape Verde as a whole is highly dependent on emigrant remittances and foreign aid. The longer term solution will be the provision of goods and services which will earn foreign exchange. However, in the narrower perspective of the project, rural works, biological or structural, will have to be financed from food aid local currency generations until other forms of employment are generated. Under WARD, the programming of public workfront activities towards the end of the project is expected to be 40% of the level of effort of similar activities under the WDP project. This decreased reliance on PL 480 funded workfront activities represents a GOCV and USAID commitment to decrease project-related employment generation. It is increasingly evident that rural workfront labor support is unsustainable at current levels, and the GOCV recognizes that it can no longer afford to build structures that do not significantly contribute to SWC objectives. The GOCV is firmly committed to exploring alternative income-generating activities for rural workers and gradually reduce workfront support to a more sustainable level. Other workfront activity, such as road construction, road and structure maintenance, and school/clinic construction, may be programmed by the GOCV to replace the expected reduction of SWC construction. In addition, as applied research and

development identifies more readily sustainable, income generating activities in agrosylvopastoralism, in the long term this can help free producers from reliance on workfronts for critical income.

3. Lessons Learned: because the WARD project is a follow-on activity of two previous projects (Watershed Development and Food Crops Research), the PP should discuss the impact of and lessons learned from these two previous projects.

Response: The section in the PP on Lessons Learned, pages 3-7, describes the major impacts of these previous/ongoing activities and summarizes the results of the evaluations of the activities. It also discusses lessons learned regarding project design/ implementation and impact monitoring.

4. Institutional Linkages: the nature and strength of GOCV institutions may be a major weakness. WARD is to work through one ministry, but two institutions that historically have weak linkages. What is the role of the proposed Coordinating Committee? Strengthening INIA's capacity to conduct research on water harvesting, water use efficiency and water runoff/solid erosion would be critical.

Response: Selection of Ribera Seca as the main target watershed under WARD will facilitate interaction among the principal GOCV agencies (INIA and DGCSAFER) and provide a more integrated setting for selected water management studies and for monitoring and evaluating impacts of technologies and practices designed to increase agricultural productivity and sustainability.

The WARD Coordinating Council will consist of the USAID project officer or project manager, the Chief of Party for the recipient, the Director General of Rural Extension (DGER), the Director General of Soil and Water Conservation and Rural Engineering (DGCSAFER) and the President of the National Institute for Agricultural Research (INIA). (See Annex D.5)

This council is to provide policy guidance and to coordinate project activities. It will also provide a forum for correcting inter-institutional deficiencies as well as provide for cooperation with other donors, particularly IFAD. Some of the major deficiencies in INIA and DGCSAFER have been taken into account in the training plan for WARD. In addition, INIA's capacity to conduct research on water harvesting, water use efficiency and water runoff/solid erosion will be strengthened through the use of recurring and short-term technical assistance under WARD.

5. Concentration of Extension Activities: because the zones where watershed management activities will occur are the main population centers and the major centers of food production in Cape Verde, it would be desirable to have GOCV extension activities concentrate in these areas.

Response: The WARD project is designating a target watershed to focus applied research, soil and water conservation and extension services in a defined area. Ribeira Seca was selected as the target watershed because of its size (it offers every agro-ecological zone available) and proximity to INIA, DGCSAFER, and the Rural Extension Service(DGER), and because it is a main population center and center of food production in Cape Verde. Although WARD will focus its main activities on the Ribeira Seca watershed, it will also support soil and water conservation activities and agricultural research in other Santiago watersheds as well.

6. Donor Coordination: since several donors are working in similar activities, the PP should discuss present and proposed mechanisms of donor coordination, with an emphasis on how to insure complimentarity. Also, how will the WARD Project and the IFAD project be mutually supportive.

Response: Several donors, including USAID, are implementing watershed management activities. Although there is no formal coordination process in place, there are various informal discussions between project personnel, especially on Santiago Island, where INIA and DGCSAFER have their headquarters. The IFAD project (a community based agricultural and livestock development project) will be a community based effort to promote integrated crop and livestock production in two Ribera Seca sub-watersheds. The project will also introduce technological innovation in family livestock management in rainfed areas and improved range management and livestock production in sylvo-pastoral areas elsewhere in the island. It is anticipated the WARD and IFAD projects will benefit from coordination at some level, especially with respect to technology transfer, extension training, and INIA activities such as sociological surveys and on-farm research. The WARD implementation team will be requested to propose a means of maintaining close contact with IFAD project personnel and look for efficient opportunities for collaboration.

7. Mission Management Load: regardless of the implementing agent, there will be a need for additional Mission support since OAR/Praia has only two USDH staff. It was recommended that a long term PSC be employed to manage the project on behalf of AID, using project funds.

Response: project funds are being budgeted to allow OAR/Praia to hire a long-term PSC project manager. This person will be under the GDO, but will have day-to-day responsibility for management of all WARD activities and will be responsible for ensuring project impacts are properly monitored.

8. Level of Technical Assistance: it was questioned whether or not the very high level of expatriate TA proposed in the PID is necessary and whether or not this had been discussed with the GOCV.

Response: Under the WARD project, long-term expatriate TA has been limited to what is necessary to assure continuity and coordination among agencies and participants. The primary role of long-term personnel, aside from their technical input, will be to manage the project implementation process and orchestrate efficient use of other project inputs. WARD will also have recurring and short-term expatriate TA. However, WARD also plans to utilize locally available Cape Verdean consultants to the extent possible. The GOCV is satisfied with the proposed level of TA anticipated.

9. Expected Achievements and Impacts: even though a positive rate of return has been estimated for the project, quantifiable achievements over the life of the project do not appear to be significant compared to the cost of the project. It was recommended that a major quantitative, people level impact (PLI) be designed and implemented by the PVO for this program. Perhaps the quantitative PLI monitoring and evaluation program could be built into the project through PVO submission of annual work plans and annual impact reports to OAR for approval. Aerial photos would also be useful - if not available from the EEC, the project should consider budgeting for such photos from LANDSAT.

Response: Analysis of the financial costs and returns of the WARD project indicate that the benefits far outweigh the costs. Even when the time value of money is considered, the project is "profitable." The internal rate of return has been calculated at 10% over a 25 year period (see Annex 4.5, Financial and Economic Analysis). Measurable benefits are mostly from increases in agricultural production. The main financial benefits from the WARD project accrue from increased irrigated land made possible by soil and water conservation efforts and from increases in agricultural productivity resulting from conservation efforts and agricultural research.

In addition to systematic tracking of biophysical impacts, WARD will mount a project-wide system for on-going monitoring of people-level impacts (PLI) across the LOP. This will follow upon completion of start-up tasks such as compiling and synthesizing existing data and literature on the project area as a whole, conducting baseline studies of the target watershed, and identifying potential "key farmers" and controls. The long-term TA in socio-economics will be responsible for designing and establishing the PLI monitoring system. (see Annex D.4 Social Soundness

It has been reported that FAO is committed to financing a new set of aerial photographs of Santiago and has scheduled flights for autumn of 1991. Such photos will be a valuable tool for structure and forest inventory, estimation of tree cover, planning, comparison of land condition with older photos, etc. Other donors are to finance aerial photos of some of the other islands as well.

10. Social Impact: the PID's discussion of social impact was rather superficial. Social implications should be examined in greater detail in the PP.

Response: A social soundness analysis can be found in Annex D.4

11. Design/Implementing Agent: a consensus was reached that a PVO with a Title XII subcontract would be feasible. However, the Title XII or similar institution must have a proven expertise in the research and development of water harvesting techniques, water runoff/soil erosion management and water use efficiency.

Response: OAR/Praia intends to implement the WARD project through a cooperative agreement with a consortium. It is likely that the USPVO will focus on watershed management activities and the University will focus on agricultural research and extension activities. Technical assistance in the areas of water harvesting techniques, water runoff/soil erosion management and water use efficiency will be included in recurring and short term technical assistance components, as well as in training programs..

WARD PID REVIEW ISSUES FROM AID/W: (90 STATE 427881, 12/20/90)
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1. Availability of PL 480 for the WARD Project: since Cape Verde does not qualify for a grant Title III program under the new Food Aid Legislation, it was recommended that a Section 416 program be considered in FY 91. However, under Section 416, the GOCV would have to pay for the ocean freight differential. AID/W stated that the GOCV would have to agree to pay the ocean freight differential for the Section 416 program before the PID is authorized. Under future years, it was hoped that a PVO could be identified to implement a Title II monetization program which would support the WARD project with local currencies.

Response: In the FY 91 Section 416(b) program, the USG has decided to pay 100% of the ocean freight costs, so this is no longer an issue. A US PVO is in the process of submitting a multi-year Title II monetization program, with the bulk of the local currencies to be programmed in support of WARD activities.

2. Sustainability of Project:

A. Agricultural Research: concern was raised on the extent of agricultural research to be undertaken and the GOCV capacity and commitment to continue this activity after the PACD. Details on the high level of TA and on INIA's accomplishments to date were also requested.

Response: INIA has benefitted from institutional-strengthening activities of the FCR project and other assistance projects. It has enjoyed a reasonable priority in government policy and received a fair amount of support. Although small in size, it is considered by some to be shining example of an agricultural research entity for sub-Saharan Africa. The 1990 joint evaluation of the FCR and WDP projects stated that INIA's research planning, strategy and administration were considered good, that research products have begun to flow and that INIA is only now at the point where it can begin to develop research applications with direct utility to conservation and agriculture. Since FCRP was primarily and institution building project, this is a reasonable outcome and WARD is a logical next step to permit application of its developed capability to on-farm research, soil and water conservation, water management and evaluation/monitoring. It is OAR/Praia understanding the INIA (as well as other research institutions) will continue to be supported as permanent GOCV institutions by the new government as it had been by the previous one.

B. Infrastructure: regarding the maintenance of watershed structures, the PID dod not make clear who was responsible for maintenance, whether GOCV has resources to maintain structures without continued donor assistance, attempts to develop user associations to perform structure maintenance. Concerns were also raised about project sustainability in view of the high level of escudo requirements from food aid local currency generations to maintain and construct resource conservation structures and to continue reforestation activities. A more detailed escudo budget which identifies the source of funds (PL 480 or GOCV regular budget).

Constraints and opportunities for potential policy changes in the area of land tenure should be considered.

Response: Infrastructure maintenance is acknowledged to be a problem. In certain low population sites and for certain kinds of structures, state financed and managed maintenance is entirely appropriate - as done in the U.S. For other sites, there is evidence that local organization/communities will maintain structures; the social science research component of WARD (also an INIA responsibility) will assist in understanding the whens and whys of this, and new government policies are expected to give new emphasis to local organizations and autonomy.

3. Mission Management Load: AID/W recommended that the project be designed as a PVO project to reduce the management burden on a 2 USDH mission. In addition, watershed management, extension and outreach activities might best be performed by PVOs. It was also recommended that since a limited number of PVOs have experience in coordinating agricultural research programs, it was concluded that experienced Title XII institutions would be be suited for such activities.

It was suggested that Title XII institutions in partnership with PVOs would be solicited to implement the project. Although first preference would be for implementation through a grant agreement, a cooperative agreement or a contract could also be considered. Mission was requested to consult further with RCO and/or RLA.

Response: OAR/Praia intends to implement the WARD project through a cooperative agreement with a consortium. OAR/Praia has decided that a cooperative agreement is more appropriate than a grant because OAR/Praia would like to have more control over the project than a grant would allow. The mission recognizes that a cooperative agreement is more management intensive than a grant and is budgeting for a long-term PSC with project funds to manage the project for OAR/Praia.

It is likely that the USPVO will focus on watershed management activities and the University will focus on agricultural research and extension activities. Technical assistance in the areas of water harvesting techniques, water runoff/soil erosion management and water use efficiency will be included in recurring and short term technical assistance components, as well as in training programs..

4. Technical Assistance: there were some concerns regarding the high cost of TA in the project and whether or not short-term TA might be more appropriate.

Response: Under the WARD project, long-term expatriate TA has been limited to what is necessary to assure continuity and coordination among agencies and participants. The primary role of long-term personnel, aside from their technical input, will be to manage the project implementation process and orchestrate efficient use of other project inputs. WARD will also have recurring and short-term expatriate TA. However, WARD also plans to utilize locally available Cape Verdean consultants to the extent possible. The GOCV is satisfied with the proposed level of TA anticipated.

5. Impact/Logframe: the outputs are process oriented rather then achievement-orierted, and the EOPS are non-quantitative and overly subjective. There is a lack of clarity in the logical linkage from outputs to EOPS, and the purpose statement appears to represent outputs.

Response: although some changes to the Log Frame were considered, it was decided that OAR/Cape Verde should revise the Log Frame after the recipient and GOCV complete baseline studies during the first year of the project. The revision should make the EOPS more quantitative and qualitative. This will permit the Mission to more effectively measure project results and recognize the successful accomplishment of project objectives. This, in turn, will enable the mission to more effectively manage the project.

Thus, a footnote should be added to the Log Frame as follows: quote The EOPS indicators will be revised and quantified by the Mission after the first year of the project, following baseline analyses to be done by the recipient and GOCV. This revision will ensure that each indicator is stated in terms of quantity, quality and time. End quote.

6. FY 91 Gray Amendment: legislation requires that at least 10% of the dollar value of any contract in excess of $500,000 be subcontracted to Gray Amendment entities. Although this requirement is only applicable to contracts, AID/W expects Mission to use its best efforts to involve a Gray Amendment entity in implementing this activity should a grant or cooperative agreement be used.

Response: The WARD project will fully comply with Gray AMendment requirements. In particular, the 17 Historically Black Colleges and Universities that are considered Title XII institutions or minority PVOs will be encouraged to submit applications for the main cooperative agreement. The ten percent contracting set-aside for disadvantaged firms will be followed where applicable. At least one Gray Amendment entity (AFRICARE) will be explicitly solicited, in addition to the RFP publication in the CBD.