PD-AAT-226

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete)

Amendment Number: 44708

DOCUMENT CODE: 3

COUNTRY/ENTITY: LIBERIA

3. PROJECT NUMBER: 669-0188

BUREAU/OFFICE: AFR

[06]

4. PROJECT TITLE (maximum 40 characters): Agricultural Research and Extension II

PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 1 DD 1 YY 94

7. ESTIMATED DATE OF OBLIGATION (Under 'B' below, enter 1, 2, 3, or 4)

A. Initial FY 84 B. Quarter 4 C. Final FY 92

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

A. FUNDING SOURCE	FIRST FY B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
(1) Appropriated Total	2700	480	3180	17180	2810	19990
(Grant)	( )	( )	( )	( )	( )	( )
(Loan)	( )	( )	( )	( )	( )	( )
(2)						
(3)						
Host Country	28	2100	2128	280	29351	29631
Other Donor(s)						
TOTALS	2728	2580	5308	17460	32161	49621

9. SCHEDULE OF AID FUNDING ($000)

A. PROJECT TITLE	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
ARDII	140	020		--	--	3180	--	19990	--
TOTALS									

SECONDARY TECHNICAL CODES (maximum 5 codes of 3 positions each)

11. SECONDARY PURPOSE CO

SECONDARY TECHNICAL CODES (maximum 7 codes of 4 positions each)

A. Code	B/A/G	BS
B. Amount	19990	19990

PROJECT PURPOSE (maximum 480 characters)

To develop the institutional capacity of Liberia's Central Agricultural Research Institute to identify the needs of subsistence farmers, to generate improved technologies responsive to these needs through adaptive research and to communicate these technologies to institutions which can extend them to farmers.

SCHEDULED EVALUATIONS: Interim MM 03 YY 86; MM 03 YY 86; Final MM 02 YY 94

14. SOURCE/ORIGIN OF GOODS AND SERVICES: 000 [X] 941 [ ] Local [X] Other (Specify) [ ]

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

APPROVED BY: Signature

Title: Mission Director, USAID/Liberia

Date Signed: MM 08 DD 27 YY 87

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

ACTION MEMORANDUM FOR THE DIRECTOR

TO : Lois Richards, DIR

FROM : Douglas T. Kline, SPPD

THRU : John Pielemeier, DD

SUBJECT: Project Authorization - Agricultural Research and Extension II Project (669-0188)

PROBLEM: Your approval is required to authorize a grant of $19,990,000 from the Section 103 Agriculture, Rural Development and Nutrition Appropriation to the Government of Liberia (GOL) for the Agricultural Research and Extension II Project (669-0188). It is planned that $3,180,000 will be obligated this year.

DISCUSSION:

A. Background

The goal of agricultural development in Liberia is to increase Liberia's food self-sufficiency, promote export crops and raise the income of Liberia's small, semi-subsistence farmers who constitute 70 percent of the nation's work force. The greatest impediment to agricultural development is the low productivity of these semi-subsistence farmers. Obstacles to agricultural production include Liberia's rolling terrain, its thin, acidic, and iron toxic soils, and the numerous pests and diseases that affect crops and livestock. In the face of these obstacles, the semi-subsistence farmer has few alternatives to traditional farming practices based on the slash-and-burn system which is highly labor intensive and produces low yields. If Liberia is to raise the output of the semi-subsistence farmers to meet its goals of greater food and cash crop production, it must develop improved technologies suited to the environmental, economic and social context of the farmer. The Central Agricultural Research Institute (CARI) at Suakoko has been charged with developing such improved technologies for the small farmer through adaptive research.

The Agricultural Research and Extension II Project is a follow-on to a five-and-one-half-year, $4.9 million project to assist CARI. The earlier project was intended to be only the initial phase of a 12-15 year effort to institutionalize CARI's adaptive research capabilities. The Phase I project concentrated on developing the most important research departments through training and technical assistance and establishing linkages with international research centers. It provided laboratory equipment and constructed housing for expatriate advisors.

B. Project Description

The purpose of this follow-on project remains the same as that for Phase I - to develop the institutional capacity of Liberia's Central Agricultural Research Institute to identify the needs of subsistence farmers, to generate improved technologies responsive to these needs through adaptive research and to communicate these technologies to institutions which can extend them to farmers.

The principal tasks for the Phase II project are: 1) Expanding and strengthening the capabilities of research departments; 2) implementing improved research administration procedures using a multi-disciplinary, problem-solving approach to research; 3) developing a Socio-Economic Department that will undertake farming systems research and extension work; 4) conducting off-station trials at the Saye Dube Outstation and on-farm testing; 5) establishing effective extension liaison links with Liberian extension agencies; 6) developing collaborative relationships with other agricultural development institutions in the area of research and testing, and 7) providing necessary equipment, facilities and infrastructure to undertake these activities.

Given the scope of activities to be undertaken to institutionalize CARI's adaptive research capabilities, the Phase II project will be implemented over 10 years. A total of 26 new professional staff positions will be created during the project. Because of the severe fiscal problems besetting the GOL, however, new project activities will be phased in so as to minimize their recurrent cost impact on Government, especially during the first half of the project. Emphasis during this period will be placed on research in field and tree crops, socio-economic research, research administration, and extension liaison. Also, the Saye Dube agricultural station will be placed under CARI and transformed into a research outstation. In the latter half of the project, more attention will be given to secondary priorities of livestock, agricultural mechanization and fisheries.

C. Financial Summary

The total project cost is estimated at $49.62 million. AID's life-of-project contribution is estimated at $19.99 million of which $3.18 million will be obligated in FY 1984. The GOL's contribution is estimated to be $29.63 million or 60% of project costs. The following table illustrates the financial inputs:

($000's)

Input	AID	GOL	Total
Technical Assistance	7,565	--	7,565
Participant Training	2,498	640	3,138
CARI Professional Staff	--	11,388	11,388
CARI Operations	--	9,072	9,072
Commodities	1,331	2,700	4,031
Construction	1,153	1,150	2,303
Miscellaneous	1,580	--	1,580
Contingency and Inflation	5,854	4,681	10,535
Total	19,981	29,631	49,612

D. Analyses and Requirements

The USAID/Liberia Project Committee has concluded from the analyses of the Project Paper that:

1. The project approach is technically and economically sound, socially acceptable and administratively feasible;

2. The technical design and cost estimates are reasonable and adequately planned, thereby satisfying the requirements of Section 611(a) of the Foreign Assistance Act, as amended;

3. The timing and funding of project activities are appropriately scheduled and the implementation plan is realistic and establishes a reasonable time frame for carrying out the project; and

4. Adequate provision has been made for project evaluation.

A 611(e) certification has been made that the GOL can effectively maintain and utilize the assistance provided by the project.

A categorical exclusion from the requirement of an initial environmental examination was approved by AID/Washington at the time of the PID review on January 18, 1984.

E. Conditions Precedent, Covenants and Waivers:

1. The Authorization contains the following conditions precedent in addition to the standard CP's to first disbursement, requiring names and signatures of responsible GOL officials and an opinion of counsel on the validity of the Project Agreement:

a. Prior to commitments after March 31, 1985, for all project activities except on-going construction and on-going training, the GOL must submit:

1) Evidence that CARI has created a Department of Socio-Economic Research satisfactory to AID with a staff of at least three professionals; and

2) Evidence that CARI has established standard procedures satisfactory to AID for the submission, review and approval of research proposals by CARI's staff.

b. Prior to commitments after June 30, 1985, the GOL must furnish to AID evidence that CARI has submitted an agricultural research strategy to the Technical Committee of the Agriculture Research Council for the Committee's approval which: 1) is consistent with Liberia's goals for national economic development, 2) is oriented toward Liberia's small farmers, 3) is socio-economically sound, and 4) covers agronomic practices as well as research on plant varieties.

c. Prior to any disbursement for the Saye Dube Outstation, the GOL must transfer Saye Dube's budget line item for operation to CARI's budget.

d. Prior to disbursement for the purchase of commodities other than those for contractor support, the GOL must furnish to AID evidence that: 1) a system of inventory control satisfactory to AID has been established for CARI's equipment and supplies, and 2) a system of routine maintenance satisfactory to AID has been established for all CARI's motor vehicles and machinery including provisions for spare parts and reordering.

e. Prior to the first issuance of Project Implementation Orders/Participants (PIO/Ps) under the Grant for long-term training, the GOL must furnish to A.I.D. a model contract, to be executed between the Grantee and each long-term trainee under the Project, which obliges the trainee to work for CARI two years for each year of training received.

2. The Authorization also contains the following covenants:

a. The GOL covenants that it will create 26 new staff positions called for in the Project Agreement and to fill these with qualified personnel in a timely fashion.

b. CARI covenants that it will provide housing, utilities, office space, secretarial support and vehicle maintenance facilities at Suakoko for the project's technical assistance team.

c. CARI and the Ministry of Agriculture covenant that they will implement the following cost savings as soon as feasible:

- Removal of the Marine Research Unit from the CARI budget

- Reduction of personnel expenditures by ten percent of 1982-83 budgeted amount by removing unproductive workers from the CARI payroll and transferring pensioners from CARI

d. The GOL covenants that it will assign annually ten MOA extension staff for no less than one year to CARI for training in subject matters recommended by the technical assistance team.

e. The MOA and CARI covenant that they will develop and agree upon a plan within six months of the signing of this agreement on the disposition of the Extension Liaison Unit and the respective roles and responsibilities of the MOA and CARI for the funding, staffing and operation of the unit.

f. The GOL covenants that it will adopt by December 1985 through its Agricultural Research Council and its Technical Committee a national agricultural research strategy based upon a draft prepared by CARI and the MOA. The GOL also covenants that the Agricultural Research Council or its Technical Committee will review this strategy annually and make revisions as it deems necessary.

g. CARI agrees to execute Memoranda of Understanding with the Bong County Agricultural Development Project, Lofa County Agricultural Development Project and Nimba County Rural Development Project covering their respective roles in off-station research and dissemination of improved varieties and technologies. CARI will submit by March 31, 1985, a plan and timetable for developing these agreements.

One waiver is also included in the authorization: a source/origin waiver for the procurement of ten motorcycles and spare parts (approximate cost $15,000) from Japan. A detailed justification is found in Annex Q of the Project Paper.

F. ECPR Approval and Issues

The ECPR approved the PID on January 18, 1984. The PID approval cable identified the following issues raised at the ECPR as needing to be addressed in the Project Paper:

1. Socio-economic factors & technology adoption

The PID cable emphasized the need to orient research to the social and economic context of the target group of small, semi-subsistence farmers. The Phase II project will introduce the farming systems research and extension approach to incorporate socio-economic factors into the research program. Also, a nutrition study was undertaken in the project design effort to identify research priorities for nutrition.

2. Extension

The PID cable noted the need to ensure that technologies developed by CARI were extended to farmers. The project will assist the Extension Liaison Office at CARI to develop extension materials, communicate technologies to extension organizations and train subject matter specialists for the Ministry of Agriculture's extension service.

3. CARI's Management and Institutional Capacity

The PID cable highlighted the need for CARI to effectively use its resources, expecially its present personnel and personnel to be trained under the project. A research strategy and research administration procedures will be developed under the project to allocate personnel and the research budget to priority areas. Also, four project evaluation will re-examine project inputs including the technical assistance and training plans in light of CARI's evolving research program.

4. Program Mortgage Implications

The PID required that an analysis of the program mortgage implication be conducted during the project design. This analysis is included as ANNEX K of the Project Paper.

G. Congressional Notification

A Congressional Notification for the project was forwarded on June 6, 1984, and the waiting period expired on June 21, 1984, without objection.

H. Project Officers

The project will be managed by John Flynn, Agricultural Economist, USAID/Liberia. Mr. George Bazel, AFR/PD/CCWAP, will be the officer responsible in AID/Washington.

H. Authority

Under Delegation of Authority 140, Revised, you have the authority to authorize projects for up to $20 million and ten years, and to waive source/origin requirements for motor vehicle transactions of less than $50,000.

RECOMMENDATION: That you sign the attached Project Authorization thereby approving life-of-project funding of $19.99 million and the requested waiver.

APPROVED: [signature]

DISAPPROVED: _____

DATE: August 31, 1984

SPED:JPaquno:rml:08/30/84

CLEARANCES
SPED:DKline [signature]
ARD:JFlynn draft
A/DP:ECostello draft
EO:RRawley draft
CON:RLeonard draft
DD:JPielemeier [signature]

PROJECT AUTHORIZATION

Name of Country: Liberia

Name of Project: Agricultural Research and Extension II

Number of Project: 669-0188

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, and the authority vested in me under Africa Bureau Delegation of Authority No. 140, Revised, I hereby authorize the Agricultural Research and Extension II Project for Liberia (the "Grantee") involving planned obligations of not to exceed $19,990,000 in grant funds over a ten-year period from the date of authorization, subject to the availability of funds in accordance with the AID OYB/allotment process, to help in financing foreign exchange and local currency costs of the project.

2. The Project will provide technical assistance, training, commodities, and construction to the Grantee to assist in strengthening the capacity of the Central Agricultural Research Institute ("CARI") to undertake adaptive agricultural research oriented to the needs of Liberia's small, semi-subsistence farmers. The Project will allow CARI to expand its research program, conduct off-station and farming systems research, and develop extension linkages with other agricultural research projects.

3. The Project shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Goods and Services

Goods and services finances by A.I.D. under the Grant shall have their source, origin, and nationality in the United States or Liberia except as A.I.D. may otherwise agree in writing. Ocean transportation costs shall be financed only on vessels under flag registry of the United States except as A.I.D. may otherwise agree in writing.

b. Conditions Precedent

The Project Agreement shall contain conditions precedent which provide, in substance, as follows:

1) Prior to commitments under the Grant after March 31, 1985, or to the issuance by A.I.D. of documentation pursuant to which such commitments will be made, for other than on-going construction and on-going training activities, the Ministry of Agriculture ("MOA") shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

a) Evidence that CARI has created a Department of Socio-Economic Research satisfactory to A.I.D. with a staff of at least three professionals; and

b) Evidence that CARI has established standard procedures satisfactory to A.I.D. for the submission, review and approval of research proposals by CARI's staff. (The essential elements of these procedures are described in Annex I of the Grant Agreement.)

2) Prior to commitments under the Grant after June 30, 1985, or to the issuance by A.I.D. of documentation pursuant to which such commitments will be made, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D. evidence that CARI has submitted an agricultural research strategy to the Technical Committee of the Agricultural Research Council for the Committee's approval which (a) is consistent with Liberia's goals for national economic development, (b) is oriented towards Liberia's small farmers, (c) is socio-economically sound, and (d) covers agronomic practices as well as research on plant varieties and includes mechanisms for coordinated, interdisciplinary research.

3) Prior to the first disbursement under the Grant, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, for the Saye Dube Agricultural Station, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., evidence of the transfer of the Grantee's budget line item for operation thereof to CARI's budget.

4) Prior to the first disbursement under the grant for the purchase of commodities other than those for contractor support, or to the issuance by A.I.D. of documentation pursuant to which such disbursement will be made, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., evidence that: (a) a system of inventory control satisfactory to A.I.D. has been established for CARI's equipment and supplies, and (b) a system of routine maintenance satisfactory to A.I.D. has been established for all CARI's motor vehicles and machinery, including provisions for spare parts and reordering.

5) Prior to the first issuance of Project Implementation Orders/Participants ("PIO/Ps") under the Grant for long-term training, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., a model contract to be executed between the Grantee and each long-term trainee under the Project, which obliges the trainee to work for CARI two years for each year of training received.

c. Special Covenants

The Project Agreement shall contain covenants which provide, in substance, as follows:

1) The Grantee agrees to create the new staff positions as called for in Annex I of this Agreement and to fill these with qualified personnel in a timely fashion.

2) CARI agrees to provide housing, utilities, office space, secretarial support and vehicle maintenance facilities at Suakoko for the Project's technical assistance team.

3) CARI and the Ministry of Agriculture covenant to implement the following cost savings as soon as feasible:

a) Removal of the Marine Research Unit from the CARI budget, and

b) Reduction of personnel expenditures by removing unproductive workers from the CARI payroll and transferring pensioners from CARI.

4) The Grantee agrees to assign annually ten MOA extension staff to CARI for not less than one year for training in subject matters recommended by the Project's technical assistance team.

5) Within six months of the signing of this agreement the MOA and CARI covenant to develop and agree upon a plan for the disposition of the Extension Liaison Unit and the respective roles and responsibilities of the MOA and CARI for the funding, staffing and operation of the unit.

6) The GOL covenants to adopt by December, 1985, through its Agricultural Research Council and its Technical Committee a national agricultural research strategy based upon a draft prepared by CARI and the MOA. The GOL also covenants that the Agricultural Research Council, or its Technical Committee, will review this strategy annually and revise it as may be deemed necessary.

7) CARI agrees to execute Memoranda of Understanding with the Bong County Agricultural Development Project, Lofa County Agricultural Development Project and Nimba County Rural Development Project covering their respective roles in off-station research and dissemination of improved varieties and technologies. CARI will submit by March 31, 1985, a plan and timetable for developing these agreements.

d. Waivers

Not withstanding paragraph 3.a. above and based upon the justification set forth in Annex Q to the Project Paper, I hereby (1) determine that special circumstances exist to justify waiving the requirement under FAA Section 636(i) to procure vehicles of U.S. manufacture; (2) certify that exclusion of procurement of motor vehicles from Free World countries, other than the cooperating country and countries included in AID Geographic

Code 941, would seriously impede the attainment of U.S. foreign policy objectives of the foreign assistance program; and (3) waive the source/origin requirements set forth in Handbook 1, Supplement B, to permit the procurement of ten trail motorbikes and spare parts from countries included in Geographic Code 935.

Date: August 31, 1984

Mission Director

USAID/Liberia

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ANNEXES

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C. Institutional and Administrative Analysis
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APPENDIXES

1. Assessment of CARI Research Capabilities and Needs
2. Nutritional Considerations for Agricultural Research

Abbreviations

ADP	-	Area Develop[illegible]nt Projects (BCADP, LCADP, NCRDP)
BCADP	-	Bong County Agricultural Development Project
CARI	-	Central Agricultural Research Institute
FAO	-	Food and Agriculture Organization
FSR/E	-	Farming Systems Research and Extensi
GDP	-	Gross Domestic Product
GOL	-	Government of Liberia
IBRD	-	International Bank for Reconstruction & Development
IDRC	-	International Development Research Center (Canada)
IMF	-	International Monetary F[illegible]d
LCADP	-	Lofa County Agricultural Development Project
MOA	-	Ministry of Agriculture
NCRDP	-	Nimba County Rural Development Project
OAU	-	Organization of African Unity
PTP	-	Partnership for Productivity
REDSO/WCA	-	Regional Economic Development Services Office West-Central Africa
ST/IT	-	Office of International Training, Science & Technology Bureau, AID
ULCAF	-	University of Liberia College of Agriculture and Forestry
UNDP	-	United Nations Development Program
WARDA	-	West Africa Rice Development Association

I. SUMMARY AND RECOMMENDATIONS

A. Grantee and Implementing Agency

The Government of Liberia (GOL) will be the Grantee. Its nominal Implementing agency will be the Ministry of Agriculture (MOA). Most implementation activities will be undertaken by the MOA's Central Agricultural Research Institute.

B. Financial Plan and Term of Project

(in $1000's)

	AID	GOL	TOTAL
Technical Assistance	7565	---	7565
CARI Operations & Personnel	---	20460	20460
Training	2498	640	3138
Commodities	1331	2700	4031
Construction	1153	1150	2303
Other Costs	1580	---	1580
Inflation & Contingency	5854	4681	10535
TOTAL	19981	29631	49612

The Project Assistance Completion Date will be 10 years from the date of signing of the project grant agreement.

C. Project Purpose

The purpose of the project is to develop the institutional capacity of Liberia's Central Agricultural Research Institute to identify the needs of subsistence farmers, to generate improved technologies responsive to these needs through adaptive research and to communicate these technologies to institutions which can extend them to farmers.

D. Background of Project

The goal of agricultural development in Liberia is to increase Liberia's food self-sufficiency, promote export crops and raise the income of Liberia's small, semi-subsistence farmers who constitute 70 percent of the nation's work force. The greatest impediment to agricultural development is the low productivity of semi-subsistence farmers. Given Liberia's rolling terrain and thin, acidic and iron toxic soils, the

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semi-subsistence farmer has few alternatives to the traditional slash-and-burn system which is highly labor intensive and produces low yields. Thus, improved technologies must be developed that will allow semi-subsistence farmers to raise more food and expand production into high value cash crops.

The Agricultural Research and Extension II Project is a follow-on to a five-and-one-half-year, $6.9 million project to assist CARI. The earlier project was intended to be only the initial phase of a 12-15 year effort to institutionalize CARI's adaptive research capabilities. The Phase I project concentrated on developing the most important research departments and establishing linkages to international research centers.

E. Project Description

The Phase II project will have several tasks:

1) Expand and strengthen the capabilities of research departments;

2) Implement improved research administration procedures which introduce a multi-disciplinary, problem-solving approach to research;

3) Develop a Socio-Economic Department that will undertake farming systems research and extension work;

4) Conduct off-station trials at the Saye Dube Outstation and on farmers' fields;

5) Develop an extension liaison unit to communicate new technologies to extension agencies;

6) Establish collaborative linkages with other Liberian agricultural development institutions; and

7) Expand services, facilities and infrastructure to support these new activities.

The project will provide 35 person years of long-term technical assistance, as well as 74 person months of short-term assistance. Some 41 CARI staff members will receive long-term training. A further 96 person months of short-term training will be provided. Twenty-six new staff members will be added to CARI's professional staff. Additional staff housing, laboratories and other facilities will be constructed. Commodities will be procured, including farm, office and laboratory equipment and supplies, and vehicles.

F. Summary Findings

The technical analysis found that the low productivity of the slash-and-burn technology currently used by Liberia's semi-subsistence farmers is the greatest constraint to the country's agricultural

development. The most effective means of addressing this problem is adaptive research employing a farming system research and extension approach. Food and tree crops are the most promising areas for research, with secondary priority being given to livestock, fisheries and agricultural mechanization.

The financial analysis concluded that, because of the GOL's grave fiscal problems, the project's recurrent costs implications must be minimized. For this reason, new hiring by CARI will be limited and phased in over the life of the project with only priority positions being filled during the first half. Also, steps are recommended for CARI to cut its recurrent expenditures to accommodate an increase in staff.

The economic analysis found that, given even very conservative estimates about the effect of the project on Liberia's agricultural productivity, the project remains economically justifiable.

G. Use of Small and Disadvantaged Businesses

The major implementation contract will be let to a Title XII university. However, bidding universities will be encouraged to subcontract with SA firms and historically black universities. The Mission will pursue the possibility of awarding the procurement services contract through a set-aside program.

H. Waiver Requirements

One waiver is required: a source/origin waiver for the procurement of ten Japanese-made trail bikes to be used by the Socio-Economic Department to conduct farm surveys (estimated cost $15,000).

I. Project Paper Team Members

Homer Erickson, Horticulturist, Chief of Party, Purdue University

John Flynn, Assistant Agricultural Development Officer, USAID/Liberia

Karl Haussler, Animal Production Specialist, Southern Indiana University

Richard Lockwood, Nutritionist, Massachusetts Institute of Technology

David Mengel, Agronomist/Extension Specialist, Purdue University

Kenneth Meyer, Veterinarian/Extension Specialist, Purdue University

Jim Pagano, Assistant Project Development Officer, USAID/Liberia

II. PROJECT RATIONALE AND DESCRIPTION

A. Project Rationale

1. Background

Liberia's economy has been in a state of decline since the early 1970's. Since 1980, GDP has declined at an average annual rate of 4.4 percent. Per capita GDP fell from $575 in 1980 to an estimated $500 in 1983. Some of Liberia's economic problems are internal: a loss of business confidence, massive capital flight, a cessation of new productive investments and a liquidity crisis within the economy caused by massive government deficits. However, a fundamental problem has been Liberia's historical dependence on the income base of a few narrow, foreign-dominated export enclaves. Three industries -- iron ore, rubber and timber -- which accounted for 83 percent of Liberia's exports and 28 percent of its GDP[1/], suffered greatly in the 1980's from declining demand and prices caused by the world recession. Moreover, Liberia's single most important export industry, iron ore, faces a secular decline as Liberia's richest and most accessible ore deposits will soon be exhausted and world demand is expected to remain depressed until the end of the decade. Similarly, the recovery of the rubber industry is expected to be modest and only gradual.

Liberia's dependence on export enclaves has had a profound effect on the structure of Liberian society as well. It has fostered a dualism between the modern sector of government, the foreign concessions and the monetized economy, and the traditional sector of subsistence farmers and "tribal" people. The agricultural sector is characteristic of this dualism. Modern agriculture composed of foreign concessions and a few relatively large, Liberian-owned commercial farms employs some nine percent of the work force while producing 14 percent of GDP (1981). In contrast, traditional farmers comprise some 70 percent of the workforce but account for only 13 percent of GDP.

In the face of these economic problems and the demands for a more equitable socio-economic order, the Government of Liberia (GOL) has outlined three major objectives in its Second Four-Year National Socio-Economic Development Plan (1981/82-1984/85):

-- Diversification of the economy;

-- Improvement of income distribution; and

-- Increased Liberianization of the economy.

These are to be achieved through promoting private and public investment in agriculture, agro-industry and manufacturing; through placing a high priority on public sector investment in directly productive activities,

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1/ Average of 1980-82 performance

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especially agriculture; through expanding the domestic economy and diversifying exports; and through emphasizing human resource development.

While the GOL is hoping to diversify the economy in several sectors, Liberia's greatest potential and comparative advantage lies in agriculture.[2/] Likewise, agricultural development also holds the prospect of achieving more equitable growth and income distribution. Guided by these dual objectives, the Second National Development Plan spells out an agricultural strategy with five major goals:

-- To stimulate the involvement and develop increased active participation of the large mass of Liberian farm families in the development of the agriculture sector.

-- To develop programs that will be designed to stimulate increases in productivity, employment and income of Liberian farmers.

-- To promote equitable access to resources and other means of production, and as a corollary, a widespread dispersion of benefits from agricultural development.

-- To promote diversification of production in the agriculture sector and to work toward self-sufficiency in food production.

-- To expand agriculture as the principal base for self-sustained economic development.

Achieving these goals requires a major reorientation of the agricultural sector. In the past, most modern agricultural inputs, services and research were available only to foreign concessions and a handful of larger commercial farms involved in the production of export crops. The new strategy requires that agricultural programs be under-taken by government to help small farmers increase production of food and other agricultural products and to do so profitably.

2. Constraints

The constraints to increasing production by Liberia's small, semi-subsistence[3/] farmers are numerous. The limited scope of the road network and lack of road maintenance contribute to the high cost of

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2/ Discussed in Technical Analysis, Annex B, p. 1.

3/ The "traditional" farmers, who represent 88% of the labor force engaged in agriculture, produce primarily for their own family's requirements. Most of them, in years of favorable weather, sell only a minor portion of their production in commercial channels. Thus they are more accurately "semi-subsistence" farmers rather than subsistence farmers. For convenience sake, they are referred to hereafter as "subsistence" farmers.

transport for agricultural products from the interior. While markets fortunately are largely unregulated and farmers are offered a very favorable incentive price for rice, the country's staple, the marketing system is still undeveloped and very small. Likewise, systems for input supply and agricultural credit are also lacking. Finally, the Ministry of Agriculture's extension service is largely under-trained, unsupported and ineffectual. Projects to address many of these problems are underway in some parts of the country. Area development projects (ADP's) in the three richest agricultural counties are providing improved extension service, credit and some inputs. (The three counties -- Bong, Lofa and Nimba -- account for 55 percent of Liberia's farm households, 67 percent of households growing cocoa, 85 percent of households growing coffee and 62 percent of Liberia's rice crop.)[4/] Feeder roads are also being built in the three counties. Improved maintenance of primary and secondary roads is the goal of the World Bank's Fifth Highway Project and a proposed project by AID (Liberia Road Maintenance, 669-0200).

The greatest and most fundamental constraint to small farmer agriculture, however, is the low productivity of the small farmer. Two recently completed agricultural sector assessments -- the World Bank's Liberia Agricultural Sector Assessment and the Report of the U.S. Presidential Mission on Agriculture in Liberia (the "Cancun" Report) -- both emphasize the low productivity of Liberia's farmers as the major obstacle to agricultural expansion.

The environmental problems faced by Liberian small farmers are typical of many tropical environments. Soils are lateritic, typically thin, fragile, and quickly exhausted. Tropical environmental factors enhance diseases and pests which constrain plant and animal production. Yields in general are very low. Farmers use a slash-and-burn system in which land is returned to fallow for seven to twelve years after producing a single field crop (usually rice), possibly followed by a vegetable or tuber crop. The great demand for labor of the slash-and-burn system limits the area that a household farms to only 3.5 acres on average. Attempts to relieve this labor constraint by tractor-type mechanization have failed so far because of the fragility of the soil, high cost and management problems. And as yet, animal traction is practically nonexistent in Liberia though expanding in neighboring countries. Land and water are not constraints to production in Liberia. Inefficient use of human labor and poor technology are.

Liberian farmers presently have practically no technological alternatives with which to overcome these obstacles. As the Cancun Mission concluded:

> The absence of appropriate technology for agricultural development and the lack of a system to create such new technology are viewed by

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4/ Data is based on Ministry of Agriculture surveys for 1983. Rice data is average of 1982 and 1983 harvests.

the Mission as the principal constraints to accelerating agricultural growth in Liberia. The Mission found that even on the plantations, the level and use of available technology is inadequate. For the subsistence farmer, the situation is worse.

There are several strategies for employing new technologies to raise farmer productivity. Yields can be increased by introducing crop varieties that are higher yielding, more responsive to chemical inputs and more disease resistant. Technologies can be developed to combat insect and vertebrate pests. Over the long run, the constraint of limited labor will eventually have to be addressed by the development of both a continuous cropping system to replace the slash-and-burn system and of improved technologies for animal traction. A rot onal system of using rice, legumes, rootcrops and vegetables holds the most promise for continuous cropping. In swampy areas, multi-cropping of irrigated rice or rice followed by vegetables holds great potential. The productivity of livestock is presently low. Potential exists for small ruminants, poultry, aquaculture and cattle (for traction animals as well as a source of protein). Finally, Liberia's climate, terrain and soils are, in general, more suited to tree crops than field crops. Economic analyses show a greater return to farmers in tree crops than in rice which is the most widely cultivated crop.5/ Thus, the transformation of Liberian small farmers from subsistence production to commercialized operations will probably entail the adoption of tree crops in the farming system.

None of the constraints faced by Liberian farmers are insurmountable as other countries with similar climates and soils have raised their agricultural production. However, the technologies employed in other countries to overcome the obstacles cannot be transferred directly to Liberia. Seed varieties, cultivation techniques and other practices must be adapted to the specific climate and soils in which they are used and specific diseases and pests they must face. Liberia has yet to make much progress in adapting technologies to meet the specific problems of producers.

The Central Agricultural Research Institute (CARI) at Suakoko, Bong County, has been in operation since 1954 under various names. However, it has suffered from deficiencies in leadership, direction and a general lack of government interest -- small farmers were never an effective priority of the Ministry of Agriculture. While it has received substantial donor assistance since its inception, this assistance has been discontinuous and not sufficiently focused on developing Liberian personnel and capabilities. Notwithstanding these limitations, CARI has developed a research institutional capacity with considerable potential.6/ However,

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5/ Discussed in Technical Analysis, Annex B, pg. 7.

6/ Discussed in detail, department by department, in Appendix I.

little effort was made to adapt and disseminate research findings to potential users. In its first 30 years of existence, the predecessors of CARI failed to make a major contribution to Liberian agriculture.7/

Many of the root causes of the earlier problems have been addressed in the last four years. The Institute now enjoys semi-autonomous status and direct control over its own budget. Under the Agricultural Research and Extension I project (669-0135), a core of senior Liberian researchers has been trained, and several are in place.

3. Phase II Project Approach

This Phase II project will consolidate the gains of Phase I and is designed to avoid past weaknesses with a thoroughly comprehensive, integrated and sustained effort.8/ The research approach is comprehensive in that it addresses the development of the entire institution rather than focussing narrowly on particular commodities. The strategy for designing the research program is based on supporting Liberia's agricultural development strategy which envisions transforming the small holder sector from subsistence to commercial agriculture, producing more food for domestic consumption and cash crops for export. The Phase II approach is integrated by developing various disciplines, including the social sciences, to provide direction in planning and designing agricultural research by identifying technical, economic and social constraints to production through using an interdisciplinary "farming systems research/extension" approach. The training plan is carefully integrated with the technical assistance component to provide advisors to work primarily with newly trained Liberian scientists. It is continuous and sustained by the long-term nature of AID commitment to the institution and through careful programming of the technical assistance team to complement and overlap with the Liberian staff. Furthermore, research results will be carefully documented and published in annual reports and other publications. All publications will be systematically filed in a modernized library at CARI and other permanent repositories. An extension series of publications will be initiated and an Extension Liaison Office will be established at CARI to assist extension agencies in transferring adapted technology to farmers.

4. Phase II Commodity Focus

Given the assumption that properly focussed and carefully planned agricultural research can solve technological problems facing Liberia's farmers a remaining challenge is to identify researchable problems and to formulate an overall research strategy that has a high probability of maximizing positive economic and social returns. The very nature of research characterized by the discovery of new information makes the outcome somewhat unpredictable. Nevertheless, existing knowledge of the

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7/ Annex C describes CARI's problems candidly and in detail.

8/ Annex B Sections II through IV.

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Liberian agricultural sector and the numerous, small producer-consumer units that comprise this subsistence sub-sector allow one to postulate certain research priorities and to allocate resources in a manner designed to address the priorities.

Rice is the most important crop in Liberia by a wide margin. The national preoccupation with rice was underscored by the 1979 riots over rumored price increases. Rice consumption in Liberia is among the highest in Africa with more than 25 percent of consumption derived from imports. Rice production in Liberia is presently very inefficient with extremely low yields and low returns to farmers' labor. It is unlikely that Liberia will become a major rice producer because of inherent ecological disadvantages (in contrast to Asian countries for example). Yet there are numerous researchable problems that if solved could have a pronounced impact on Liberian rice production. The issues are complex, however, and solutions require a multi-disciplinary and coordinated effort. A critical mass of scientists working together in the involved disciplines is necessary for a successful research program.

Cassava and other roots and tubers are the second most important food crop in Liberia, thus deserving priority attention. The domestic market demand for cassava is reportedly thin at present price relationships. However, potential for producing cassava for export exists. Inducing more efficient production is essential to increase market competitiveness and is a real possibility through adapting existing high yielding varieties of West Africa and improved management practices.

Tree crops, particularly coffee and cocoa, are the most important agricultural foreign exchange earners after rubber. Yields in Liberia are exceedingly low, less than two-thirds those of neighboring Ivory Coast. Although world markets for these commodities are quite restricted, considerable improvements in technical efficiency are feasible. Palm oil shows considerable export potential if costs of production can be lowered. There is virtually no existing technology for improving yields for these commodities in Liberia. Technical efficiencies need to be developed through research. While support for increased production of these commodities is required, production increases in principal foods must have first priority.

Livestock production is not presently an important production enterprise with farmers in Liberia although demand for meat products is reportedly strong. Small ruminants are the most prevalent livestock, but the use of these animals is not well documented. Based on current knowledge, livestock should receive a lower priority than crops, at least until farm-level studies, particularly regarding animal traction, indicate otherwise. A possible exception is inland fisheries. Small scale aquaculture, although presently at a very small magnitude, has shown a great deal of promise in several counties through efforts of the Peace Corps and the ADP's. Very basic technology has been imported from Zaire and other African countries by the Peace Corps. Testing alternate management practices should be ranked as an intermediate priority for CARI.

It should be clear that commodity research reaches across disciplines. Soil scientists, plant breeders and plant protection specialists back up agronomists trained for particular crops. The entire effort must be coordinated by strong research administration with close cooperation of social scientists. The program must remain dynamic and responsive to farmer needs through deliberate mechanisms designed to provide two-way communication with end users of innovations. The plan outlined in this paper lays out the development of a research institution that is capable of addressing these priorities in a comprehensive, integrated and coordinated manner.

B. Project Description

1. Goal and Purpose

The Agricultural Research and Extension II project is a follow-on to a five-and-one-half-year, $4.9 million project to assist CARI. The goal of the Phase II project, like its predecessor, is to raise rural incomes and increase Liberia's food self-reliance. The project seeks to raise the productivity and efficiency of Liberia's small farmers and promote new or improved cash and food crops. To meet this goal, Liberia will have to introduce improved technological packages adapted to the needs of small farmers.

The purpose of the project is to develop the institutional capacity of Liberia's Central Agricultural Research Institute to identify the needs of subsistence farmers and to generate improved technologies responsive to these needs through adaptive research and to communicate these technologies to institutions which can extend them to farmers.

2. Progress to Date

As conceived in the Project Paper (PP) for the first phase project, developing CARI's capability to do adaptive research would require four tasks:

a. To develop a fully qualified staff capable of administering an agricultural research system which produces reliable research results related to priority farmer needs;

b. To develop and then to disseminate sound crop and livestock production technology packages adapted to farmers resources and values through extension subject matter specialists to extension personnel in the MOA's extension service and development projects;

c. To incorporate appropriate research results from regional and international agricultural research centers into the Liberian applied research program; and

d. To construct and equip facilities at CARI sufficient to run a high-quality adaptive research program.

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The Phase I project was intended to be only the first step in a 12-15 year effort to strengthen CARI's institutional capability. It made substantial progress in several areas. Eleven staff members received degrees or are presently enrolled in degree programs. At least two more are expected to leave for training prior to the end of Phase I. Several of CARI's research departments have initiated major research programs, particularly the Crop Science Department which has focused on rice variety trials, cassava research and vegetables (the latter with the support of the International Development Research Center (IDRC), Canada). Substantial progress has also been made in Land and Water Resources and Plant Protection (the latter supported by the UN Food and Agricultural Organization (FAO)). CARI's administration has been revamped. It has been given semi-autonomous status with control over its budget. CARI has established effective and useful linkages with several international research centers and development organizations, including the signing of Memoranda of Understanding with FAO, IDRC, the International Rice Research Institute, the International Institute for Tropical Agriculture, and the Asian Vegetable Research and Development Center. Finally, improvements to CARI's facilities have been made, including the construction of six staff houses for expatriate advisors, the construction (funded by the GOL) and equipping (funded by USAID) of three laboratories which are now under way, the recently initiated rehabilitation of water and electricity services and the procurement of farm machinery, vehicles and other commodities.

3. Detailed Description

a. Priority Task Summary

Building on this progress, the follow-on Phase II project must undertake several major tasks to fulfill the goal of institutionalizing CARI's adaptive research capacity and to embark on a major program to adapt technology to producer resources. It will add depth to CARI research departments and initiate research programs in several areas that have been neglected thus far. It will develop systems to better focus research resources on priority problems and to obtain greater impact on production through integrating economic and social factors into research design and planning and through improved research administration. It will develop a system for converting research results into usable technological packages and disseminating these to extension organizations. Finally, the project will address the need to provide CARI with the facilities and infrastructure which will enable it to attract and retain professional staff with the qualifications and dedication to conduct high quality agricultural research.

Specifically, during the first five years of the project CARI will be assisted in the following priority tasks:

1) Initiating the farming systems research/extension (FSR/E) approach of adapting improved agricultural technology to the conditions of small subsistence farmers through the interdisciplinary efforts of natural and social scientists.

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2) Undertaking research to identify improved varieties and develop agricultural techniques which will enhance the yield potential of those varieties for rice and other cereals identified by FSR/E surveys as important to farmers, for roots and tubers, for the major tree crops as well as minor tree crops with potential for increased productivity in the near term, for vegetables, and edible and forage legumes.

3) Undertaking research on technologies to increase the productivity of Liberia's soils and to reduce soil erosion and degradation.

4) Undertaking research to improve the agricultural mechanization and improved crop storage opportunities for small, subsistence farmers with particular emphasis on increasing the economic attractiveness of animal traction.

5) Improving research administration through introduction of successful management techniques for reviewing, approving and supervising research activities and operating a national research facility.

6) Verifying central station research through conducting off-station research at selected locations in different agro-climatic zones, including the proposed station at Saye Dube in Grand Gedeh County.

7) Developing a strong Extension Liaison section with effective linkages to the national agricultural extension service, to the integrated area agricultural development projects in Bong, Lofa and Nimba Counties and to other entities involved in the transfer of technology to farmers as well as to establish a strong agricultural communications system to develop and disseminate appropriately crafted extension literature.

8) Identifying, scheduling, placing and supporting participants for long and short-term training in the U.S.

9) Developing an <u>esprit de corps</u> among its staff through fostering increased professionalism, increased awareness of international research activities in their professional specialities and through increased contacts with international professionals.

In the latter half of the project, more resources will be devoted to agricultural engineering, animal science and inland fisheries. The designation of the tasks for the second stage will be more precisely defined as a result of the series of evaluations planned for the first five years of the project and supplemented by a special design effort. This effort will build upon the experience of the first five years. Depending on performance of the project contractor, these tasks may be incorporated in the contract as an amendment prior to the end of the fifth year.

b. <u>Research Program - Central Station</u>

Under Phase II, the capacity of CARI's research departments will be expanded to encompass research topics that have been largely neglected to date because of insufficient personnel or facilities. In some cases

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this will entail initiating research programs in departments that have been moribund. Specific areas where research capabilities will be strengthened include:

1) Crop Science -- Research in tree crops (particularly coffee, cocoa and oil palm) will become a greater priority. The FAO will provide technical assistance and this project will train two tree crops specialists. Legumes and pulses will be studied, both as food crops and as rotation crops in various cropping systems. Project technical assistance will work with the on-going programs in rice, tubers and roots, and strengthen vegetable research, including the development of improved varieties and management practices. Twelve department members will receive long term training, including seven new staff members over the life of the Phase II project, reflecting the high priority given to crops. The project will finance five person-years of long-term technical assistance.

2) Land and Water Resources -- Soil chemistry and fertility research need to be expanded, particularly on the relationship of various soils and soil treatments (e.g. fertilizer, crop rotation, etc.) to crop production. This department must coordinate very closely with Crop Sciences through an interdisciplinary research focus. As the conversion of Liberia's small farmers from a slash-and-burn to a continuous-cropping system is a principal long-term goal, CARI must undertake research in soil microbiology and soil conservation and management. An analytical laboratory will be equipped to provide greater support services to the research programs of this and other departments. The department will also assist in a pilot soil survey project being funded by the European Economic Community which might be expanded to a national scale. This department is already relatively well staffed but seven staff members will receive additional long-term training, including three new staffers, over the life of the project. Phase II will provide two person-years of long-term technical assistance .

3) Plant Protection -- In addition to initiating research on weed control, research will be funded on developing integrated biological and chemical programs to control plant diseases and insects as well as control invertebrate pests, particularly birds. The Plant Protection Department will require a laboratory to carry out this research, and two additional research staff. Five staff are slated for further training with two person-years of long-term technical assistance. This department will continue to receive considerable support from FAO through at least 1986.

4) Animal Science -- Small ruminants hold considerable promise for small farmers. Swine, cattle and poultry also have potential. The obstacles to increased animal production are numerous and not well understood, but include disease, nutrition and social factors. CARI must first collect and study data on the characteristics of indigenous species, the traditional livestock production system and the factors governing the adoption of animal traction before research can contribute to improving management practices, indigenous bloodlines and to introducing animal traction. Until animal production is determined to be a greater priority as a result of farm level studies, this department will receive only modest

attention by the project.[9/] Three persons are planned for long-term training, including two new hires, and only two person-years of long-term technical assistance is planned.

5) Fisheries -- Fisheries have been introduced only recently into subsistence farming systems. Preliminary indications are that small farmers are enthusiastic about this supplemental food source. However, improvements are needed in the system of management now being used. To date, the CARI Inland Fisheries Department has served as a propagator only and has not conducted research. This is a small department with only two professional staff. CARI will hire an additional staff member who will receive long-term training under Phase II. Research ponds and related facilities are needed. The project will provide TDY assistance to help guide the research program. The propagation function is proposed to be spun off as soon as a reliable commercial operation is established.

6) Agricultural Engineering and Appropriate Technology -- At present, CARI is conducting work in post-harvest technologies, mostly on rice, and agricultural mechanization in two departments. This work will be combined into a single department. Post-harvest research should look into the storage of other crops, especially cash crops where maintaining quality is important. Agricultural engineering research should expand into soil and water mechanics to complement research in swamp rice and dry season irrigated vegetable production. Introduction of continuous cropping systems also requires new tillage technologies including priority emphasis on animal-drawn implements and animal-traction technology generally. An engineer trained in Phase I returns in 1984 along with a process engineer trained by FAO. These two will form the core staff with two new hires added in mid-project. The two new staff will receive long-term training. The project will provide two years of long-term technical assistance.

The expanded research program in Phase II will demand an increase in the number of CARI scientists and technicians and an upgrading of the professional qualifications of some existing staff members. Additional laboratory space and/or other facilities are required for the plant protection, agricultural engineering and fisheries programs. New equipment is needed by virtually every department.

c. Off-Station Research

Much of CARI's research work conducted during Phase I and before is ready for testing and verification in different agro-climatic areas and on farmers' fields. To date off-station testing has been conducted on a limited, informal, ad hoc basis through personal contacts of CARI staff with personnel from other agricultural development projects. CARI needs to apply a systematic approach to off-station testing and verification so that extension personnel and farmers can have confidence in the seed varieties and management practices that CARI proposes. This approach will have two components.

9/ Discussed in Technical Analysis, Annex B.

1) Out-Station -- A branch research station will be established at Saye Dube, Grand Gedeh County, to test research results in a different climate (wet in contrast to Suakoko, which is relatively dry for Liberia) and soils. Station facilities developed by the MOA at Saye Dube include 2,300 acres of land with 200 acres cleared for lowland rice, staff housing, service buildings for a workshop, supplies storage and a machine shed.

2) Off-Station -- A formal mechanism will be created with area development projects, the University of Liberia and other entities to conduct off-station testing for CARI. These would include on-farm trials supervised jointly by CARI personnel and ADP or MOA extension staff.

d. Socio-Economic and Farming Systems Research and Extension

Phase II will also promote a new means of integrating socio-economic considerations into CARI's research program. This will require the creation of a Department of Socio-Economic Analysis and an inter-departmental Farming Systems Research/Extension (FSR/E) Committee.

The Socio-Economic Department will have as a major responsibility providing direction in planning and designing agricultural research by identifying technical, economic and social constraints to production within subsistence farming systems. This "farming systems" approach will allow CARI to focus its research in areas where new technologies are likely to be adopted and have the greatest beneficial impact. Such analysis will require that the unit conduct survey work to collect systematic, comprehensive data on subsistence farming systems. Crop and livestock budgets will be created and integrated into whole farm budgets. These, in turn, can be analyzed through linear programing to assess the likely impact of new technologies and derive combinations of farm enterprises that will optimize benefits to farmers.

The Socio-Economic Department will have as its second responsibility the analysis of feasibility of technologies through the on-farm trials. A multi-disciplinary FSR/E team composed of not only social scientists from the Socio-Economic Department but also, soil, livestock, agronomic and other scientists, as appropriate, will conduct on-farm trials. An interdisciplinary Farming Systems Research Committee which will include the Socio-Economic Officer and Extension Officer as well as production research scientists will supervise this research. The FSR/E team will examine not only the physical performance and characteristics of the technology but also its interaction with other elements of the farming system and its economic and social viability.

Because the department now consists of only one Liberian researcher, considerable input is required to make it functional. An advisor experienced in farm management research with subsistence farmers is needed throughout much of the period to provide guidance and support. Also, a sociologist advisor is needed to help analyze the behavioral variables in Liberian farming systems. An additional three professional staff for CARI are needed early in the project to provide a "critical" mass

of expertise in the social sciences. In all, ten person years of technical assistance and nine years of participant training are provided for this very important area.

e. Research Administration

The Research Coordinator will assist the CARI Director to integrate various departments' research activities into coordinated, interdisdiplinary projects focused on specific tasks or problems. Socio-economic analysis focused on the farming system as a whole is one means by which CARI's research can be more effectively directed towards areas where it will have the greatest impact on small farmers. This will require that CARI's Socio-Economic Department be involved in the review and approval of research proposals. CARI will also need to develop a standard format and procedure for reviewing and approving research proposals involving the Research Coordinator, another research scientist, the Socio-Economics Officer and a statistician who will examine research design issues. They will evaluate research proposals for funding based on an approved CARI research strategy, which in turn will reflect priorities identified by socio-economic and technical studies of the agricultural sector.

f. Extension Liaison

Historically, one of CARI's greatest shortcomings has been its failure to communicate its research results to people who could put them to use. CARI's reputation for doing nothing over its 30-year existence derives in some part from the fact that whatever useful research it conducted was never made known to the public. A major thrust of Phase II, then is to establish communications channels between CARI and various organizations in agriculture, including the ADP's, the MOA's extension service and the Rural Development Institute. Phase II will activate the CARI Extension Liaison Office to provide these groups with research data and findings, information on new technologies and management practices, and on improved plant materials and breeding stock for propagation. It will also act as a channel of communication for extension services which require CARI's assistance to solve specific problems.

Two CARI staff members are being trained in extension methodologies under Phase I, an economist and a social scientist. These two will form the core of the extension liaison function with the assistance of a long-term advisor. No additional long term training is envisioned as both staff will have PhD's. However, eight person-years of long term technical assistance by experienced extension advisors is programmed.

g. Linkages

During Phase 1, CARI established formal links and effective working relations with various international agricultural research organizations. Phase II will concentrate on establishing and formalizing

linkages between CARI and Liberian institutions. These will cover the respective roles of institutions in extension, off-station testing and cooperative research.

The three Agricultural Development Projects (BCADP, LCADP and NCRDP) and CARI will mutually benefit from formal ties which define their respective roles. The ADPs have well established and functioning extension systems with close farmer contacts. CARI can be much more efficient in expanding on-farm testing and in diffusing newly developed technology by working closely with the ADPs.

Likewise, the University of Liberia's College of Agriculture and Forestry (ULCAF) has a well trained group of agriculture faculty that should be involved in collaborative research with CARI. The ULCAF campus at Fendall offers potential for replicating research performed in other zones of Liberia and interaction between CARI researchers and University faculty will stimulate broader discussion of research issues.

Agreements with other institutions such as the Rural Development Institute, and the AID-funded upper Nimba Rural Technology Project will enhance the flow of information to and from CARI.

h. Institutional Support

CARI's ability to attract and retain highly qualified and motivated staff will depend to a large degree on the quality of support facilities they are offered in both their professional and personal lives. CARI has upgraded and expanded facilities for several departments under Phase I. As noted above, some additional research facilities are required during Phase II. In addition, the CARI research library needs to be greatly improved. Also, more office space is needed as well as a conference room where CARI can hold staff meetings.

Personal amenities are important to morale and thus the quality of professional work. Moreover, since CARI's salaries are comparable to other government salaries and are low compared to the private sector, CARI must use such amenities to compete with private employers and compensate for the relative isolation of CARI's rural location. During Phase II, some of CARI's capital budget should be allocated towards building and renovating staff housing, a school building for staff children and some recreational facilities.

The expansion of CARI's operations will place a burden on general administrative and support functions. To improve these capabilities the project will provide training in the areas of administration and management, library science and maintenance.

Thus, the task of fully institutionalizing CARI's adaptive research capacity in all relevant fields is quite extensive. Virtually all departments require additional assistance and resources. A total of 36 new positions have been identified to fully staff all departments and administrative functions (these are listed in Table 1). However, the GOL

has extremely limited resources with which to meet these needs. Most importantly, its ability to absorb the increased recurrent costs of hiring additional staff will be extremely constrained. As is discussed in the Financial Analysis (Annex F), the GOL's development budget will be greatly constrained in 1984/85 and subsequent years because of the nation's ongoing economic and fiscal crisis and there is little prospect for a full recovery in the economy and a corresponding large increase in the development budget in the near term.

Table I-1 presents a schedule by which CARI would fill new staff positions. It assumes that 16 positions will be filled in the first five years and an additional ten positions added in years six and seven. The final ten of the 36 new staff positions identified by the project design team are not scheduled to be filled during the life of the project, based on best estimates of the GOL's fiscal position and the enduring nature of CARI's research priority. However, this schedule must be handled flexibly and be continually reassessed in the light of the GOL's budget position, its hiring freeze and changes in CARI's research priorities. Likewise, project inputs such as long-term technical assistance are often keyed to new positions being filled. Thus, the project plan must be submitted to periodic review to assess possible revisions resulting from the changing circumstance of the project. The four scheduled project evaluations would be the most appropriate occasions to conduct such reviews (see Section VI, Evaluation Plan).

C. Project Inputs

1. Additional CARI Staff

The following summary of project inputs is based on the schedule of new hires in Table I-1. The plans for new hires and project inputs are the best estimates possible at the time of the project design. As these may be revised, certain inputs in the technical assistance and training plans must be changed as well.

2. AID Inputs

a. Technical Assistance

Technical assistance will be a major component of the project. This will include 35 years of long-term advisors and 62 person/months of short-term assistance. Advisors will not hold line positions but instead will act as counterparts to Liberian scientists who are newly returned from training and lack experience in developing a research program or directing a department. The largest amount of technical assistance will be in the areas of extension liaison (eight person-years) and agricultural economics/farming systems research (ten person-years), two activities that are new to CARI for the most part. Other areas that will receive long-term technical assistance will be Crop Science (five years), Research Coordination (four years), Animal Science (two years), Agricultural Engineering (two years), Soils (two years) and Plant Protection (two years).

Table I-1

SCHEDULE FOR HIRING NEW PERSONNEL

YR Hired (GOL FY)	Position	Department	Minimum Qualification To Hire
1984/85	Out-Station Director*	Out-Station	M.S. Agr.
	Out-Station Technician*	Out-Station	B.S. Agr.
	Out-station Agronomist*	Out-Station	B.S. Agr.
	Agricultural Econ.*	Socio-Economic	M.S. Econ.
	Rural Sociologist*	Socio-Economic	B.S. Soc. Science
1985/86	Statistician*	Research Coord.	B.S. Math.
	Agricultural Econ.*	Socio-Economic	B.S. Econ.
	Root & Tuber Breeder*	Crop Science	B.S. Agr.
1986/87	Vegetable Breeder*	Crop Science	B.S. Agr.
	Oil Palm Specialist*	Crop Science	B.S. Agr.
	Instrument Technician*	Soils & Water	Diploma
1987/88	Root & Tuber Tissue Culturist*	Crop Science	B.S. Agr.
	Librarian*	Library	B.A. English
	Weed Science*	Plant Protection	B.S. Agr.
1988/89	Tree Propagation*	Crop Science	B.S. Agr.
	Small Ruminent Spec.*	Animal Science	B.S. Agr.
1989/90	Veterinarian/ Parasitologist	Animal Science	B.S. Bio.

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* Indicates minimum new staff requirements that must be met in first five years of project.

	Maize Agronomist	Crop Science	B.S. Agr.
	Water & Soil Mechanics	Agricultural Eng.	B.S. Phys. Sci./Eng.
	Plant Pathologist	Plant Protection	B.S. Agr.
	Soil Conservation/ Management Spec.	Soils and Water	B.S. Agr.
	Legume/Pulse Breeder	Crop Science	B.S. Agr.
1990/91	Extension Specialist	Extension	B.S. Agr.
	Fish Pond Management	Fisheries	B.S. Agr.
	Lab. Technologist	Ag. Engineering	Diploma
	Soil Survey	Soils & Water	B.S. Agr./Physics

Additional Positions
to be Filled if Funding is Available

1985/86	Agricultural Econ.	Socio-Economic	B.S. Econ.
	Agricultural Econ.	Socio-Economic	B.S. Econ
1988/89	Rice Geneticist	Crop Science	B.S. Agr.
	Root & Tuber Agron.	Crop Science	B.S. Agr.
1989/90	Cattle Specialist	Animal Science	B.S. Agr.
	Fruit Tree Specialist	Crop Science	B.S. Agr.
	Meteorologist/ Climatologist	Soils & Water	B.S. Agr./Physics
1990/91	Swine Specialist	Animal Science	B.S. Agr.
	Maize Breeder	Crop Science	B.S. Agr.
	Vertebrate Pest Spec.	Plant Protection	B.S. Agr.

b. Training

Training will be the other major input of the project with some 41 participants planned to receive 104 person-years of training. This includes 17 present staff members who are slated for further training and 24 persons who will be added to CARI's staff. Most will be trained at the M.S. level though provision is made for some PhD's or equivalents, as well as bachelors and associate degrees for technical training. Also, 96 person-months of short-term training have been allocated both for short-term technical courses and seminars, workshops and conferences. In addition, the project will provide funding for six participants to complete degree programs initiated under Phase 1.

c. Commodities

The project will provide commodities to equip CARI's new labs and to supplement the current complement of field equipment. Although total commodity procurement is modest in total amount at approximately $1.3 million, the array of items is sufficiently diverse to constitute a rather complex procurement. The Director of CARI and Chief of Party for the technical assistance contractor will be responsible for developing specifications but procurement will be handled by a Procurement Services Agent as described in the Implementation section and Annex II.

d. Construction

The other major project input is the upgrading of CARI's physical facilities. Approximately $1.1 million of project funds are allocated to constructing new staff housing, additional laboratories and storage facilities and upgrading the electrical generating and distribution system.

3. GOL Inputs

GOL inputs will include CARI's existing staff and operations including participants and counterpart staff for the technical assistance team, the conversion of the Saye Dube agricultural station into a research out-station, and the addition of at least 26 new members to CARI's professional and technical staff. To support this new staff CARI will need to construct at least 20 new staff houses and procure equipment. In addition, the GOL will complete a guest house for CARI, make some additions to the existing administrative building for holding meetings, and construct some community/recreational facilities.

4. Other Donor Inputs

Other donor inputs will include continued technical assistance by the FAO in plant protection (through 1986), tree crops (through 1986) and post-harvest technology (through December, 1984). In addition, the IBRD may contribute funds through its Bong County Agricultural Development Project for rice variety trials and other research topics of special interest to BCADP.

This project design has taken other planned donor assistance into account in order to avoid duplications of effort. The UNDP/FAO and AID projects have coordinated closely in the past and this cooperation will continue throughout Phase II. Likewise, CARI will cooperate closely with the three ADPs (all of which are donor financed). The AID funded Agricultural Sector Analysis and Planning Project will coordinate closely with the Phase II project in various areas of economic research with CARI concentrating on farm level research and the Planning Project dealing more with macroeconomic issues.

D. Extension/Research Linkage

This project does not contain a major, national extension service strengthening component. Extension linkage with research will be provided through a new Extension Liaison section at CARI. This section will assist the MOA train extension subject matter specialists amongst its several functions. The Extension Liaison section will train field extension personnel in the technical packages developed for farmers by the respective research specialists from CARI.

The appropriate design for an effective nationwide extension system for subsistence farmers requires additional analysis before a project can be developed to provide overall strengthening support to a national system. Traditional extension project approaches suitable for even moderately monetized rural economies are not effective in societies which have subsistence farming systems and which are only marginally monetized.

The development of applicable and appropriate technology for subsistence farmers will require from three to five years to produce even first generation results, thus time is available to study an appropriate extension approach in the event that other donors do not initiate a strengthening program on a national basis. Further, the extension programs in the ADPs in Lofa, Nimba and Bong counties are sufficiently effective at present to transfer new technologies developed by CARI in the near future to the largest population of progressive farmers in the country.

During the first two years of the project, the research program will focus primarily on addressing production constraints in Nimba, Lofa and Grand Gedeh counties which already have effective extension programs.

III. COST ESTIMATE AND FINANCIAL PLAN

A. Cost Estimate

AID's estimated contribution to the project is $19.99 million. This includes $7.6 million for technical assistance, $2.5 million for participant training, $1.1 million for construction, and $1.3 million for commodities with the balance to cover local support costs, inflation and contingency (see Table III-1). Cost estimates for technical assistance were derived from recent experience with other USAID projects. Participant training costs are based on ST/IT estimates. Those for construction are based on estimates supplied by local contractors and recent construction at CARI. Estimates for commodity costs were derived from equipment lists compiled by CARI's various departments. However, these lists were taken to be illustrative as commodity needs cannot be foreseen over the life of the project. Thus, equipment costs are given in general terms.

Local support costs financed by the grant include fuel for the technical assistance team's vehicles and back-up generator, miscellaneous small shelf-items for research projects, vehicle and housing maintenance and miscellaneous local services.

Predicting inflation rates for ten years is highly problematical. A rate of eight percent was used as a conservative estimate for the U.S. rate.

Because of the uncertainty of the GOL's financial situation, two financial scenario's have been developed. Under the first, the GOL contribution to the project is estimated to be $29.6 million (see Table III-2). This cost estimate assumes that the salary and support cost per professional staffer remain at the 1982/83 budgeted level which is considerably above the actual current expenditure rate since budgeted funds are not allocated on a timely basis. As discussed in the Financial Analysis (Annex D), the GOL's present fiscal crisis will probably continue for several years allowing little, if any, growth in the GOL's Development Budget which funds CARI.

The Financial Analysis (Annex D), therefore, also presents a second scenario with CARI's operating cost based on the actual recent expenditure rates. Projecting this reduced rate over the life of project would result in cummulative GOL base cost of $18.0 million (or $11.6 million less than the first scenario) before adding the incremental costs to support the new staff required by the project. Under this scenario, CARI could continue to support the project by trimming support services and equipment by 15 percent of the budgeted amount. Further cost cutting measures could be taken in the event that future budget allocations prove insufficient to accommodate inflation and the full incremental costs associated with the increased staff levels called for by the project. Eliminating the marine boat crew, transferring pensioners from CARI's budget as well as unproductive or unneeded workers are potential cost saving measures that could be taken. These measures would allow adding approximately three new professional level staff members with associated support costs.

Table III-1

Projected AID Expenditures by Fiscal Year
(in $1000's)

	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
A. Technical Assistance											
Long-term Advisors (P/Ys)	(5)	(6)	(6)	(6)	(3)	(3)	(4)	(2)	—	—	(35)
Annual Cost @ $ 35,000/Year	975	1170	1170	1170	585	585	780	390	—	—	6825
Short-term Advisors (No. of one month TDYs)	(4)	(9)	(6)	(9)	(6)	(10)	(7)	(7)	(10)	(6)	(74)
Annual Cost @ $12,000/TDY	40	90	60	90	60	100	70	70	100	60	740
Subtotal	1015	1260	1230	1260	645	685	850	460	100	60	7565
B. Participant Training											
Long-term Training (P/Ys)	(12.0)	(11.0)	(10.5)	(12.0)	(14.5)	(17.0)	(19.0)	(12.0)	(2.0)	—	(110)
Annual Cost @ $20,000/Year	240	220	210	240	290	340	380	240	40	—	2200
Short-term Training (P/Ms)	(18)	(10)	(10)	(10)	(10)	(10)	(8)	(8)	(8)	(4)	(95)
Annual Cost @ $3,100/Month	56	31	31	31	31	31	25	25	25	12	298
Subtotal	296	251	241	271	321	371	405	265	65	12	2498
C. Construction	412	257	264	220	—	—	—	—	—	—	1153
D. Commodities	356	200	200	150	125	50	150	50	50	—	1331
E. Miscellaneous											
On-campus Backstopping	75	75	75	75	75	75	75	75	50	25	675
Administrative Assistant	40	40	40	40	40	40	40	—	—	—	280
Local Support Costs	75	100	100	100	75	75	50	50	—	—	625
Subtotal	190	215	215	215	190	190	165	125	50	25	1580
F. Total	2269	2183	2150	2116	1281	1296	1570	900	265	97	14127
Contingency @ 10%	227	218	215	212	128	130	157	90	26	10	1413
Subtotal	2496	2401	2365	2328	1409	1426	1727	990	291	107	15539
Inflation @ .08%	—	192	394	605	508	669	1013	707	248	107	4442
G. GRAND TOTAL	2496	2593	2759	2932	1917	2095	2740	1696	539	214	19931

Table III-2

Projected Total GOL Expenditures for Project by GOL Budget Year
($1,000's)

Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
1. Existing CARI Operations											
a. Personnel	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	10,600
b. Support Costs	580	580	580	580	580	580	580	580	580	580	5,800
c. Equipment	230	230	230	230	230	230	230	230	230	230	2,300
d. Subtotal	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	18,700
e. Inflation	--	30	65	100	140	400	495	590	690	790	3,300
f. Total	1,870	1,900	1,935	1,970	2,010	2,270	2,365	2,460	2,560	2,660	22,000
2. Project Incremental Costs											
g. Personnel	40	56	68	88	100	152	164	168	192	200	1,228
h. Support	51	51	51	85	119	170	221	272	374	408	1,802
i. Equipment	--	--	--	--	--	50	75	75	100	100	400
j. Construction	--	150	--	150	50	200	200	200	200	--	1,150
k. Subtotal	91	257	119	323	269	572	660	715	866	708	4,580

Table III-2 continued

Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
l. Inflation	--	10	4	29	29	97	145	193	281	258	1,046
m. Total	91	267	123	352	298	669	805	908	1,147	966	5,626
3. Saye Dube											
n. Outstations	167	167	167	167	167	167	167	167	167	167	1,670
o. Inflation	--	7	14	21	28	36	44	53	61	71	335
p. Total	167	174	181	188	195	203	211	220	228	238	2,005
Grand Total	2,128	2,341	2,239	2,510	2,503	3,142	3,381	3,588	3,935	3,864	29,631

As indicated above, the project will require certain new staff for CARI. Costs associated with the additional staff, including support costs, are herein called project incremental costs. These are costs borne by the GOL which are over and above the base level of current expenditures and are presented as the incremental GOL cost of the project on line n of Table III-2. Note that because of reductions in support service costs and with reduced costs for construction, the projected CARI budget through the first five years of the project might actually be less than the 1983/84 budgeted amount, (Table D-4, Annex D) even though an additional 14 new staff are hired during this period. However, expenditures for year five would increase over the current expenditure level by about 25 percent.

Support costs are utilities, vehicle repairs, scientific materials, local and international travel, various materials and supplies, equipment and maintenance. See Table D-3 in Annex D (Financial Analysis) for a detailed breakdown of budgeted and actual expenditures analysis of CARI support cost items.

If the GOL's fiscal position improves, new staff hirings can be accelerated and expanded. The cost of an additional professional staff position is estimated to be $25,000: $8,000 salary and $17,000 for professional and personal support costs. It should be noted that most new positions will not impose this total cost until three or more years after the position is filled. During the first year, most new employees will be in a probationary status during which CARI will assess their suitability for becoming permanent research staff members. During this period, the candidate will receive salary but will not require most support services as he/she will not be conducting independent research but assisting senior researchers. If the candidate proved to be satisfactory, he/she will in nearly all cases be sent for long-term training during which the candidate will receive half salary and require little additional support. Only upon the candidate's return from training will the full cost of $25,000 be incurred. Table III-3 gives a detailed breakdown of the project's incremental costs, including the phasing of new hiring.

The final item which comprises the GOL's contribution to the project is the operating budget for Saye Dube. This item is already in the Development Budget and does not represent an incremental cost to the project. (Additional professional staff to conduct research at Saye Dube are an incremental cost of the project and are included as such.)

With all items, the inflation rate was projected at 4 percent to reflect the present trend in Liberia prices which is partially the result of the economy's depressed state. While inflation may not remain so low over the course of the project, it is likely to continue at its present low rate for several years. Also, it is assumed that the present government wage freeze will remain in force through 1988/89.

Table III-3

COL Incremental Expenditures for Project by COL Budget Year
(in $1000's)

Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
1. Personnel											
a. (Number of New Hires) (Cumulative)	(5)	(8)	(11)	(14)	(16)	(22)	(26)	(26)	(26)	(26)	
b. (Number on Station)	(5)	(6)	(6)	(8)	(9)	(16)	(15)	(16)	(22)	(24)	
c. (Number in Training)	(-)	(2)	(5)	(6)	(7)	(6)	(11)	(10)	(4)	(2)	
Salary Costs	40	56	68	88	100	152	164	168	192	200	1228
Support Costs											
d. (Number requiring Support)	(3)	(3)	(3)	(5)	(7)	(10)	(13)	(16)	(22)	(24)	
e. Cost	51	51	51	85	119	170	221	272	374	408	1802
Commodities						50	75	75	100	100	400

Table III-3 Continued.

Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
4. Construction											
g. Number of Houses		(3)		(3)		(3)	(4)	(3)	(4)		
h. Cost of Houses		150		150		150	200	150	200		1000
i. Other Construction					50	50		50			150
5. j. Total	91	257	119	323	269	572	660	715	866	708	4580
k. Inflation	0	16	6	41	36	117	170	222	317	265	1190
5. l. Grand Total	91	273	125	364	305	689	830	937	1183	973	5770

Table III-4

SUMMARY COST ESTIMATE AND FINANCIAL PLAN

(in $1000's)

	AID			GOL			Total		
	FX	LC	Total	FX	LC	Total	FX	LC	Total
Technical Assistance	7565	--	7565	--	--	--	7565	--	7565
Participant Training	2498	--	2498	200	440	640	2698	440	3138
CARI Professional Staff	--	--	--	--	11388	11388	--	11388	11388
CARI Operations	--	--	--	--	9072	9072	--	9072	9072
Commodities	1331	--	1331	--	2700	2700	1331	2700	4031
Construction	--	1153	1153	--	1150	1150	--	2303	2303
Miscellaneous	675	905	1580	--	--	--	675	905	1580
Contingency and Inflation	5104	750	5854	80	4601	4681	5184	5351	10535
TOTAL	17173	2808	19981	280	29351	29631	17453	32159	49612

Table III-5

AID Obligation Schedule:
(in $1000's)

FY 84	3180
FY 85	1626
FY 86	2060
FY 87	2230
FY 88	1990
FY 89	2300
FY 90	2190
FY 91	2700
FY 92	1114
TOTAL	19990

B. Financial Plan

The following table illustrates the means of financing for the various implementation methods used in the project.

Methods of Implementation	Method of Financing	Cost($000)
Technical Assistance: AID Direct Contract, Title XII	Letter of Credit: Treasury Financial Communications System (LOC-TFCS)	$11,700
Technical Assistance (Project Evaluation): AID Direct Contract, Non-PSC	Direct Payment	200
Participant Training: AID Direct Contract, Title XII	LOC-TFCS	3,700
Participant Training: Placement by USAID Mission	Direct Payment - Transfer of Funds to AID/W	300
Construction (Building Design, construction and supervision): AID Direct Contracts	Direct Payment	1,500
Commodities: AID Direct Contract, Proc. Svcs. Agency	Direct Payment and Letter of Commitment	1,500
Local Support Costs (Commodities and services): USAID-issued Purchase Orders	Direct Payment	1,000

This Plan is in accord with AID's preferred methods of financing. Likewise, host country contracting will not be used. Thus, no justification is required for the methods of financing selected.

IV. IMPLEMENTATION PLAN

A. General Responsibilities

1. GOL

The Ministry of Agriculture will be the nominal implementing agency for the GOL. However, given CARI's semi-autonomous status within the MOA, many of the GOL's implementation responsibilities will fall to CARI.

The greatest GOL responsibility will be meeting CARI's operational costs including the increased recurrent costs required to expand CARI's research program. This will include increasing CARI's professional staff by creating and filling at least 26 new positions. Likewise, additional support services will be required by the larger professional staff. CARI and the MOA will be responsible for identifying suitable candidates to fill these newly created positions.

In most cases, it has been assumed that CARI's new staff will require long-term training to qualify for the positions they are to assume. CARI will be responsible for paying the candidates international air fare for training, maintaining the candidate at half-salary while in training and executing a contract or bonding agreement with each candidate that will oblige the candidate to return to CARI upon the completion of his/her training and work for CARI at least two years for each year of training received. CARI will also be responsible for the international travel and salaries of short-term participants.

CARI will be responsible for the housing of long-term and short-term advisors at Suakoko. The six staff houses constructed by AID under Phase I will be used to house the Phase II long-term technical assistance team. CARI will provide utilities including electrical power and water service to the TA team residences. CARI will also provide routine maintenance for the TA team vehicles although spare parts will be purchased with AID funds outside the TA contract. CARI will also provide office space and general secretarial services for the research activities of the TA team although specific contract business such as financial reports will be handled by the contractor's administrative assistant.

Finally, the MOA will be responsible for insuring the cooperation of its constituent agricultural programs and projects with CARI's activities in extension liaison, off-station trials and pilot farmer trials. This will include providing subject matter specialists from the MOA extension service to work at CARI with the Extension Liaison office. The MOA will also ensure that CARI receives a sufficient budget to carry out the project with complete control over its budget. Also, the MOA will ensure that the budget line item for the Saye Dube station is transferred from the MOA budget to CARI. The MOA will also assure that the semi-autonomous status of CARI remains in force and that the Agricultural Research Council gives broad policy guidance to CARI. The relationship and linkages between CARI and the MOA should remain close with CARI exercising its authority over the budget and personnel.

2. USAID

USAID will contract directly with a Title XII Institution for technical assistance and the U.S. portion of the participant training under the project. Participants placed in non-U.S. institutions will be funded directly by USAID. It will contract separately for consultants to conduct external evaluations of the project (discussed below in Section VI). It will also contract for commodity procurement and related services, for AID-funded construction and for design and supervision of construction. USAID will also fund miscellaneous local support costs for the technical assistance team outside of the TA contract. These costs typically include procurement of small shelf items, fuel for the technical assistance team, and miscellaneous local services (e.g. maintenance of the staff residences and other costs required for local support). The TA team, in consultation with the Director of CARI, is responsible for arranging for the items and will prepare a budget for USAID approval. Funds will then be advanced by USAID on a revolving account basis. This method has been found more effective than including funds for the items in the contract.

USAID will be responsible for project monitoring, and the USAID Project Manager will serve as the primary contact point for the technical assistance team's Chief-of-Party and will be responsible for obtaining decisions on contract and project matters. USAID will prepare necessary Project Implementation Orders and Project Implementation Letters and will be responsible for preparation of all project evaluation summaries and coordinating the four external evaluations.

3. Contractors

A Title XII Institution will be selected by competitive negotiation procedures to act as the major implementing agent. The contractor will provide long-term and short-term technical assistance (but not the evaluation teams which will be handled directly by USAID), and be responsible for placing and funding participants for training in the U.S. in appropriate training courses. The contractor will also assist CARI to develop the specifications for commodities to be procured. Because of the advantage of creating a long-term relationship with a U.S. educational institution that may endure even after this project is completed, it is desirable that the contractor be a well established agricultural education and research institution although offers from consortia will also be considered. Offers are also welcome from educational institutions that subcontract part of the project inputs to historically black agricultural educational institutions, private firms or private voluntary organizations.

Local contractors for construction activities will be selected by AID in consultation with CARI through competitive procurement procedures. Construction, construction design and supervision will be through AID direct contracts. Procurement of commodities will be both direct AID procurement and through a procurement services agent. The procurement services contract may be awarded through a set-aside program. Annex H provides details of the procurement under the project.

B. Technical Assistance Plan

The project will provide technical assistance to CARI in the form of 35 person/years of long-term AID-financed advisors (Table IV-1), and the services of an estimated 62 short-term (one month) consultancies and 12 person months for evaluation outside of the Title XII contract (Table IV-2). The Title XII university which is awarded the project implementation contract will recruit the entire technical assistance staff from among University Faculties.

The long-term advisors, all of whom will be located at CARI in Suakoko, will function as counterparts to Liberian staff members at the Institute rather than assuming line positions themselves. Long-term technical assistance is intended to provide support to those departments and activities that are relatively new and lack experienced staff. The arrival of advisors is generally timed to coincide with the return of long-term participants from training to serve as counterparts.

The technical assistance team will comprise the following long-term advisors:

Research Coordinator: This research coordination advisor (1985-88) will work with CARI's Research Coordinator in devising effective procedures for submitting, reviewing and approving research proposals. He will also advise on methods for integrating and prioritizing research in different disciplines and departments to achieve the goals of CARI's research strategy. He will assist in supervising the entire research program. Since a comparable advisor existed in the Phase I project, this position can be terminated by the fourth year of Phase II.

Extension Liaison: An extension advisor (1985-1992) will work with the two Liberian extension specialists being trained under the Phase I project to set up the Extension Liaison unit. Because such an effort is new to CARI and the failure of communications between CARI and agricultural users has been one of the institution's greatest problems, considerable attention will be placed on this unit. Thus, the extension advisor position will have the longest duration, eight years.

Socio-Economic Department: An agricultural economist (1985-1991) will be needed for most of the project to work with the Socio-Economics Department in setting up farming systems research, including conducting surveys and on-farm trials and evaluating the economic of technical packages proposed for formers. A Rural Sociologist (1985-1987) will also work with the unit in collecting sociological and cultural data relevant to farming practices. It is anticipated that the Liberian sociologist to be hired by CARI will probably require graduate training. Thus, the sociologist advisor will have to direct the department's sociological work for at least the first two years. By the third year the Liberian counterpart should return from training. The sociology advisor should overlap with his/her Liberian counterpart for at least a year to assist in the continuation of the program.

TABLE IV-1

Technical Assistance Plan: Schedule of Long-term Advisors

Specialty	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Person Years
Soil Fertility/Chemistry	1	1									2
Agricultural Economics	1	1	1	1	1*	1*	1*				7
Research Coordinator	1*	1*	1*	1*							4
Sociologist	1	1	1								3
Extension **	1	1	1	1	1	1	1	1			8
Agronomist/Plant Breeder		1	1	1							3
Ag. Mechanization/Approp. Tech.			1	1							2
Legume Prod./Soil Microbiology				1	1						2
Weed Science						1	1				2
Animal Science/Nutrition	—	—	—	—	—	—	1	1	—	—	2
TOTALS	5	6	6	6	3	3	4	2	0	0	35

* also Chief-of-Party
** also a discipline specialist

Table IV-2

TECHNICAL ASSISTANCE PLAN: SHORT TERM ADVISORS

Advisors	Number of TDY's
Analytical Chemist	4
Soil Fertility/Chemistry	3
Meterologist/Climatologist	2
Weed Specialist	2
Plant Virologist	2
Nematologist	2
Seed Technologist	2
Fisheries Specialist	4
Personnel Management	1
Micro-Propagaton (Tissue Culture) Specialist	1
Irrigation Specialist	2
Statistician	3
Tropical Fruits Horticulturist	1
Agricultural Mechanization & Engineering	10
Library Science	1
Agricultural Economist	5
Rural Sociologist	2
Veterinary Microbiologist	1
Livestock Parasitologist	2
Animal Nutritionist	2

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Table IV-2 cont

Research Administration	2
Agronomist	3
Legume Agronomist	2
Human Nutritionist	3
Project Evaluators	12
TOTAL	74

Crop Science: An agronomist/plant breeding specialist (1986-1988) will assist with the varietal screening and breeding programs for various crops with the help of TDY assistance on crop-specific techniques. Initially he/she will work with the Liberian rice breeder being trained under Phase I. Breeders in legumes and root/tuber crops will be trained under Phase II and should return in time to overlap with the agronomist/breeder for at least one year. A legume and soil microbiology specialist (1988-1989) will work with the crop science department on legumes, nitrogen-fixation and their role in crop rotation cycles. The advisor's arrival should be timed so that he/she will overlap with the soils microbiologist in the Land and Water Resources Department who should return from training in 1988 or 1989.

Land and Water Resources: An advisor on soil fertility and chemistry (1985-1986) is needed at the inception of the project to work with the recently returned department head on establishing the department's research program and coordinating the work of the department's analytical laboratory with the needs of other departments for laboratory work.

Agricultural Engineering: The agricultural engineering advisor (1987-1988) will work principally in the area of agricultural mechanization (including animal traction) and appropriate technology. He/she will have a secondary responsibility in working with the CARI maintenance department in improving maintenance procedures for agricultural equipment and other machinery.

Plant Protection: An advisor on weed science (1990-1991) will work with a newly trained Liberian weed scientist on developing a program in this area which is vital to a continuous cropping technology.

Animal Science: An animal scientist/nutritionist advisor (1991-1992) will work with the Animal Science Department's animal nutritionist (who will receive Ph.D. training under the project) and with a new small ruminant specialist to be hired and trained under Phase II.

The project has been planned to maintain long term technical assistance staff to the minimum in both number and duration of assignments. The rationale for this is to foster full Liberianization of the research program as rapidly as possible. Experience has established however, that periodic technical consultation over an extended period is almost indispensable to the acquisition of the skill required to conduct a technology development and transfer program as fast as is proposed in this project for most LDC institutes such as CARI which are in the early development stage.

To increase the effectiveness of the long-term advisors, one-month TDYs have been budgeted for each advisor (except for those arriving the first year) for orientation and preplanning research activities with their CARI counterparts. Additional short term TA assistance has been provided for from two to four years after the long term assignments for high impact consultation visits with the CARI personnel, many of whom will be relatively new in their professional career.

The evaluations will examine the efficacy of this approach on the basis of the concept itself as well as on the basis of the changing needs expected as development dynamics are hopefully initiated. Project evaluations must address whether any and which of the previous short term consultancies should be continued and which new short-term consultancies are required.

C. Training Plan

Staff training will be a major project input. Seventeen members of current CARI staff have been identified for long-term training. In addition, it is assumed that 24 of the persons hired to fill new staff positions at CARI will need long-term training. Table IV-3 shows the schedule of long-term training. Consideration should be given to placing participants in quality agricultural programs in West Africa (e.g., University of Ibadan) where environmental and institutional conditions would be similar to Liberia. Short-term courses will be used to improve the skills of CARI professionals and technicians. Twenty-seven person months of short-term training in five specific areas has already been identified. An additional 69 person months of short-term training is allotted for staff to take short courses and attend seminars and workshops to upgrade skills and stay current with research in their speciality.

D. Construction Plan

Several vital additions will be made to CARI's physical plant during Phase II. AID will fund the construction of laboratories for the Plant Protection and Agriculture Engineering Departments, research ponds for the Fisheries Department, housing for senior staff and major improvements to CARI's electrical system. Table IV-4 provides cost estimates and timing of AID-funded construction.

A major requirement for CARI's physical plant will be additional staff housing for the new hires under Phase II. While AID will be providing four additional houses, 20 more will be required over the life of project. These will be funded by the GOL. Also, CARI needs a guest house. WARDA has one on station which has never been completed. CARI should arrange to complete the building and share it with WARDA if possible. Otherwise, one will have to be constructed.

Staff housing and service buildings have been constructed by the MOA at the Saye Dube substation site. The budget for Saye Dube will be adequate to maintain and staff these facilities. Project inputs financed by AID for Saye Dube are limited to a modest amount of equipment and machinery to be jointly agreed upon by CARI, the TA contractor and USAID.

E. Commodity Procurement Plan

Under the project AID will finance the purchase of various commodities and equipment for CARI including research and office equipment, vehicles, library materials, farm equipment, and mini computers. A listing of commodities with estimated cost is found on Table IV-5.

TABLE IV-3

Training Plan

Long-Term Trainees	Dept.	85	86	87	88	89	90	91	92	93	Total	Degree
		Fiscal Year (Person Years)										
Entomologist*	Plant	1	1								2	MS
Rural Sociologist	Econ	1	1								2	MS
Maintenance Tech.*	Adm	1	1								2	AA
Outstation Agronomist	Out	1	1								2	MS
Tree Crop Spec.*	Crop	1	1	.5							2.5	MS
Animal Nutritionist*	Animal	1	1	1	1						4	PhD
Statistician	Adm		1	1							2	MS
Agricultural Economist	Econ		1	1							2	MS
Seed Technologist*	Crop		1	1	1	1					4	BS
Root Crop Breeder	Crop		1	1							2	MS
Soil Microbiologist*	L&W		1	1							2	MS
Management/Accounting*	Adm			1	1						2	MS
Vegetable Breeder	Crop			1	1						2	MS
Instrument Technician	L&W			1	1						2	AA
Oil Palm Specialist	Crop			1	1	.5					2.5	MS
Librarian	Adm				1	1					2	MS
Weed Scientist	Plant				1	1					2	MS
Tissue Cult./Propagate.	Crop				1	1					2	MS
Agricultural Economist	Econ				1	1	1				3	PhD
Soil Fertility Spec.*	L&W				1	1	1	1			4	PhD
Fish Production Spec.*	Fish				1	1	1	1			4	PhD
Small Ruminant Spec.	Animal					1	1				2	MS
Agricultural Economist*	Econ					1	1				2	MS
Tree Propagation Spec.	Crop					1	1				2	MS
Root/Tuber Phys./Nutr.*	Crop					1	1	1	1		4	PhD
Entomologist*	Plant					1	1	1	1		4	PhD
Plant Pathologist*	Plant					1	1	1	1		4	PhD
Soil Survey*	L&W					1	1	1	1		4	PhD

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Table IV-3 continued

Long-Term Trainees	Dept.	85	86	87	88	89	90	91	92	93	Total	Degree
					Fiscal Year (Person Years)							
Soil Management Spec.	L&W						1	1			2	MS
Plant Pathologist	Plant						1	1			2	MS
Fish Management Spec.	Fish						1	1			2	MS
Lab. Technician	Eng						1	1			2	AA
Legume/Pulse Spec.	Crop						1	1			2	MS
Maize Agronomist	Crop						1	1			2	MS
Process Engineer*	Eng						1	1			2	MS
Soil & Water Mechanic	Eng						1	1	1	1	4	BS
Veterinarian	Animal						1	1	1	1	4	DVM
Extensionist	Ext							1	1		2	MS
Vegetable Prod. Spec.*	Crop							1	1		2	MS
Soil fertility Spec.*	L&W							1	1		2	MS
Soil Survey	L&W							1	1		2	MS
TOTALS		6	11	10.5	12	14.5	17	19	12	2	104	

Table IV-3 continued

Short-Term Training	Dept.	85	86	87	88	89	90	91	92	93	94	Total
						Fiscal Year (Person Months)						
Soil Survey*	L&W	6										6
Tissue Culture*	Crop	6										6
Environmental Instr.	L&W	6										6
Computer Operation	Adm.		3									3
Maint. Equip. & Util.	Adm.			6								6
Others, include. seminars and workshops		—	7	4	10	10	10	8	8	8	4	69
TOTALS (person/months)		18	[illegible]	10	10	10	10	8	8	8	4	96

*Indicates Current Staff

Department Key -- Adm: Administration; Animal: Animal Science; Crop: Crop Science; Econ: Socio-Economics; Eng: Agricultural Engineering; Ext: Extension Liaison; Fish: Inland Fisheries; L&W: Land & Water Resources; Out: Out-station; Plant: Plant Protection

Table IV-4

PLAN FOR USAID-FINANCED CONSTRUCTION

Construction	Cost	Year
Staff Houses (4)	$ 318,000	1
Fertilizer & Chemical Storage - 20' x 30'	27,600	1
Fish Research Ponds - 10 acres	40,000	1
Machine Shed - 20' x 40'	16,000	1
Fencing for Research Plots (2 miles)	10,000	1-3
Agricultural Engineering Building - 5,000 sq.ft.	230,000	2
Library Expansion	25,900	2
Tissue Culture Facilities - 25'x 30'	34,500	3
Plant Protection Building	230,000	3
Expansion of Electrical Capacity	220,000	4
TOTAL	$1,152,000	

Procurement will be performed by a procurement services agency (PSA) for all goods except for vehicles, mini computers, library materials, local cost procurement and possibly audio-visual equipment. While the PSA will be contracted to CARI to do the procurement, USAID will make the arrangements for selection (in consultation with CARI), contracting and payment.

Vehicles and mini-computers will be procured directly by USAID or some other U.S. government agency. Library books will be purchased through AID's American Overseas Book Company contract. USAID may choose to purchase audio-visual and darkroom equipment through the U.S. General Services Administration rather than have the PSA procure them.

USAID will be responsible for procurement of local cost items.

Details of procurement procedures, eligibility of commodities and the schedule for their procurement are found in Annex G.

Table IV-5

AID-FINANCED COMMODITIES

		Amount
Vehicles (project)	13 @ $12,000	$ 156,000
Motorbikes (Econ)	10 @ $ 1,500	15,000
Library Fund		50,000
AV and Darkroom Equipment and Supplies		15,000
Computers (mini)	3 @ 8,333.33	25,000
Commodities for Animal Sci. & Vet.		200,000
Commodities for Ag. Eng. & Appro. Tech.		150,000
Commodities for Analytical Lab		150,000
Commodities for Crop Science		100,000
Commodities for Plant Protection		50,000
Commodities for Farm Operations (irrigation, machinery, spare parts, etc.)		150,000
Commodities for Saye Dube Station		30,000
Economic Research & Office Equipment		40,000
Extension Liaison Expenses		50,000
Total		$1,181,000
Fund for Cooperative Off-station Research (10 years at $15,000/Yr)		150,000
Grand Total		$1,331,000

V. MONITORING PLAN

Project monitoring will be the responsibility of USAID/Liberia's Agricultural and Rural Development Office. The present project manager for the Phase I project will continue as project manager for Phase II.

The technical assistance contractor, in conjunction with CARI's administration, will prepare an annual work plan for submission for USAID approval. This plan will provide the major targets and benchmarks by which they and USAID can monitor the project's progress. The work plan should include an annual technical assistance plan, training plan, procurement plan and construction plan for all assistance funded by AID. It should also set out major objectives to be attained during the year toward the project's outputs. In addition, it should reference concurrent actions required of CARI and other GOL entities to meet these outputs. The contractor will submit brief quarterly progress reports to USAID and the Director of CARI as well as more detailed annual reports. Quarterly financial reports will also be submitted in conjunction with the quarterly and annual progress reports.

The contractor's annual work plan will have to be closely coordinated with CARI's annual submission of research proposals to the Technical Committee. The Technical Committee is a subordinate body of the Agricultural Research Council which is supposed to set Liberia's agricultural research policy. (It has not met as of yet). The Council is chaired by the Minister of Agriculture and includes government and private members. The Technical Committee is composed of representatives of the Agricultural Research Council at a technical level, CARI's Director and Research Coordinator and the Deputy Minister of Agriculture for Technical Affairs, who serves as chairman. The Technical Committee is effectively the governing board of CARI (see Annex C, part I.A.). The AID project manager will sit with the Technical Committee and participate in its review of research proposals. Likewise, the AID project manager and the Technical Committee will meet quarterly to review CARI's quarterly progress reports and its annual research report.

The contractor's annual work plan developed jointly with the Director of CARI will set out major commodity procurements for each year. The AID project manager will then prepare a procurement schedule by which he will monitor the PSA's progress in obtaining the commodities.

Likewise, the contractor's annual report developed jointly with the Director of CARI will contain a construction plan. A contact construction supervisor will be responsible for monitoring construction activities. The USAID Engineer will monitor the construction contractor's performance.

Finally, the project manager will make site visits on average every two-to-three weeks to monitor project progress.

VI. EVALUATION PLAN

Outside evaluations are planned for years two, four, six and nine of the project. Because of the large size of the project, its length and the difficulty of foreseeing all contingencies in an institution-building project, it was decided that evaluations should be held every two years throughout most of the project. This will allow the Mission, MOA and CARI to reconsider, reorient or redesign project elements in ample time to correct deficiencies in the project design or address unforeseen problems. In particular, the evaluation team must examine the assumptions about CARI's budgetary position and its effect on the numbers and timing of hiring new professional research staff. Also, the evaluation team must review the precedence given to particular departments for hiring new staff and receiving technical assistance in light of CARI's evolving research strategy and research priorities The evaluation in year four will consider progress in achieving objectives and assess the adequacy of the GOL contribution for the second five years. The evaluation in year nine will consider what, if any, additional assistance may be needed by CARI.

The evaluations will be conducted by USAID and the GOL with the assistance of outside consultants. USAID will contract directly for the evaluation consultants rather than go through the Title XII contractor. Three consultants are budgeted for each evaluation.

The following list illustrates the benchmarks by which the evaluations will judge project progress.

BENCHMARKS

2 Years

Have 6 advisors on site

Agricultural engineering building completed

Finish construction of 4 houses

Functional, adequate power and water facilities

Fencing of most critical fruit and vegetable areas

Propagation house, greenhouse and tissue culture facilities completed and in active use

Research Strategy Developed

Preliminary research programs for all departments developed

Interdepartmental research program for continuous cropping developed

Formal linkages established with ADP's with active cooperation visible

At least one cooperative research project with University of Liberia

Off-station research sites selected and some adaptive testing initiated in Lofa, Bong and Nimba Counties

A policy formulated for assembling and printing extension information

Pilot on-farm trials initiated for testing technologies ready for adaption in Lofa, Bong and Nimba Counties and for training extension field staff in conducting such trails.

Research project peer review initiated

Policy established for some degree of research funding flexibility at department level

Begin to involve University of Liberia and RDI students in research projects during vacation periods

Saye Dube Station operational with staff of three

Comprehensive plans for utilization of Saye Dube Station developed

Surveys relating to farming systems, including animal production underway

Have operational computers and word processors

Communication (radio) with ADP's, Saye Dube and University of Liberia in place

Internal communication network installed

Completion of fish research facilities (ponds, etc.)

Procurement of commodities for first two years completed.

Participants selected and placed for first two years

New staff scheduled for hiring first two years on board

Ten MOA extension Staff assigned to CARI for training as subject matter specialists

4 Years

Have 6 advisors on site

The 3 laboratory buildings fully equipped and functional

Fencing of fruit, vegetable and pasture areas completed

Up to three cooperative research projects with University of Liberia in force

Printing and distribution of extension information from all departments is routine

Regular schedule of radio programs for extension initiated

Adaptive research conducted routinely at off-station research sites in Lofa, Bong and Nimba Counties including continuous cropping technology

Three additional off-station research sites established in counties of next priority

Expand pilot on-farm trials and training of extension agents in three first priority counties

Preliminary technology packages developed for major food and tree crops in these three counties

Policy formulated for systematic training of extension workers

Annual reports policy issued to include seminars scheduled for each researcher to present his/her work

Well-established mechanism functioning to have full, interdisciplinary coordination in on-farm testing of developing technologies and systematic feed-back of producer problems to CARI

Have library policy developed, especially procurement, abstraction journals, methods of obtaining gratis materials, and library management (should be in expanded facilities)

Devise policy for attracting additional donor support

Have 6-8 Phase II long-term trainees back at CARI

Phase out the propagation function (fruit trees - fish)

Have a full-time statistician in place

Continue involvement of University of Liberia and RDI students.

Adequate maintenance and repair facilities supporting research efforts

Plant Protection laboratory completed and equipped

Recommendations (based on research results) for cultural methods such as planting time, fertility, varieties and harvest procedures for major vegetables and root crops in print and being promoted

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Production systems for swamp rice developed

New staff scheduled for hiring on board

6 Years

Production technology packages developed for all major food and tree crops for three first priority counties

Adaptive research conducted routinely at three second priority off-station research sites

Preliminary recommendations for small ruminant husbandry and for use of animal traction.

Preliminary technology packages developed for major food tree crops for three second priority counties

Progressively advanced research being developed at CARI in all departments

Progressively advanced research being adapted at off-station research sites in three first priority counties.

Close cooperation in force with University of Liberia

Extension information output becomes routine, and reaches all parts of the country

Systematic training of extension workers underway in Lofa, Bong and Nimba counties

Initiation of pilot farm testing of continuous cropping system technology and animal traction in these three priority counties

On-farm testing of research is expanded, with much input from farming systems committee

Library becomes fully functional

Streamlined research support staff with well trained technicians, but with reduction in total numbers

Trained administrative support staff (accountants, etc.)

10-15 Phase II long-term trainees back at CARI

New varieties of major food crops and tree crops continually being developed and seed supplies increased

Recommendations made for companion cropping, succession cropping and minimum tillage for various crops

New staff scheduled to be hired for CARI for the period on board

9 Years

All departments are fully functional.

Most long-term trainees have returned.

Useable quality research results flowing from all departments
Production technology packages for major food and tree crops developed for six priority counties

Adaptive research being conducted at off-station sites in next three priority counties

Preliminary technology packages developed in next three priority counties

Pilot on-farm testing of technology packages and training of extension workers initiated in next three priority counties

Pilot on-farm testing continuous cropping and animal traction being conducted in six top priority counties

Pilot on-farm testing of technology packages for small ruminants and cattle being tested first three priority counties

Interdisciplinary Farming Systems Research Extension team routinely reporting producer problems with new technology packages to CARI from nine priority counties

Close institutional and operational linkages exist with University of Liberia, RDI, and ADP's.

CARI has come to attract attention as a productive research institute. International visitors increase.

CARI scientists routinely publish in recognized journals.

Economics and farming systems research has presented a vivid picture of the Liberian small farmer and his development needs.

The most economically viable crops and livestock have been identified and their benefits quantified.

Repair and maintenance facilities have been developed and properly staffed.

Research administration functions smoothly and provides good, efficient support for the research staff.

Extension liaison provides the extension services with information and coordinates CARI participation in extension.

Twenty six new hire staff for CARI on board along with appropriate support staff

VII. SUMMARY OF ANALYSES

There is little doubt that low productivity remains the major constraint to increasing income and production among Liberia's small holders. Though numerous other constraints have been identified -- labor shortage in peak seasons, lack of information, access to markets, credit, etc. -- relieving these constraints alone will have only marginal impact simply because farmers cannot significantly increase their production given their present technologies.

Liberia's experience as well as that in many other countries demonstrates that adaptive research is essential to introducing more productive resources. Attempts to use high input, high yielding swamp rice technologies developed and implemented successfully in Asia have failed for a variety of reasons. Likewise, western-style, large-scale, mechanized rice farms have proven to be unsuitable for agronomic, economic and social reasons. While both high-input and mechanized technologies, particularly animal traction, may hold some promise in Liberia, it is only through adaptive research that they can be made feasible.

The task of adaptive research, then, is to select and modify technologies so that they are feasible in the context of the farming system(s) that are to adopt them. Feasibility, however, extends beyond the technical issues of increased yields and productivity. It must encompass the economic and financial viability of the technology, particularly the incentive to the farmer for adopting it. Likewise, it takes into account a technology's acceptability in the social and institutional context.

The technical constraints that research must overcome are numerous. Most important are the low fertility and high fragility of tropical soils. To date, the best technological response to this has been a slash-and-burn system. However, this system is highly labor intensive and limits the average farm size to 3.5 acres. At the same time, yields are low and extensive arable land is not economically utilized in agriculture.

Technologies to overcome these constraints will have to raise yields, increase the productivity of labor, or both. Yields may be increased by selecting better yielding varieties, using more chemical inputs or altering cultural practices. Relieving the labor constraint imposed by slash-and-burn agriculture will eventually require developing a system of continuous cropping to replace shifting cultivation. Development of means to increase productivity per person hour, thereby increasing capability to cultivate more land per person, demands development of mechanization technology appropriate to Liberia's resources, primarily animal traction.

Economic factors favor a shift from a predominately subsistence system centered on rice culture to an integrated food/cash crop system which includes high value, export crops such as coffee, cocoa, oil palm and rubber. Analysis of farm enterprise budgets indicate that the return to labor for tree crops is several times that for rice. Other enterprises such as fish culture may also be profitable. Some untraditional use of traditional crops such as cassava as an animal feed likewise hold promise. In contrast, indigenous rice does not seem to hold much potential for becoming competitive with imported rice.

On the other hand, social factors mitigate against a shift from subsistence food crops to tree or other cash crops. The present household structure, division of labor and land tenure system is oriented toward insuring that the subsistence food needs are given precedence over maximizing income. Indeed, the preference for food (i.e. rice) security over agricultural profitability pervades Liberian society and is a central feature of the GOL's agricultural policy.

Liberian farm families, as most farm families in Africa, have learned from experience that it is imprudent to depend upon the marketplace for goods, particularly food, needed for survival. Economic and political upheavals have been endemic. The transition to increased cash crop production must be based on increased productivity of family labor in the production of food. This will, in turn, allow scarce labor to be allocated to other higher value enterprises. Increased specialization of cash crops can be expected to evolve as farm labor productivity increases and confidence is gained in the economic and political stability of the country.

Given these general criteria for technical, social and economic feasibility, the general outline of an adaptive research strategy for CARI becomes evident: its principal short-term goals would be to raise the yields of existing (mostly food) crops through improved varieties and cultural practices and cash crops that could be introduced without major disruption to the existing farming system. Over the longer term, the goal would be a continuous cropping system which incorporates high-value cash crops and enterprises and necessary subsistence crops.

Moreover, the subsistence system tends to be highly conservative, favoring technological innovations such as higher yielding varieties which can be adopted without modifying other aspects of the farming system. However, social response is a dynamic element which interacts with economic and technical factors. Over the short-term, social factors may seem to be constraints to technological change. However, over a longer time frame, they tend to evolve in response to new circumstances. As the Social Analysis (Annex E) indicates, CARI's research will eventually affect the farmer's social system including the functioning of the household, the land tenure system, etc. The strategy and methods of research will to a great extent determine what these effects will be.

To move from this broad outline of an agricultural strategy 1/ to specific research topics requires a detailed knowledge of exactly how the present farming system works and which technological innovations can be most readily applied. As has been argued above, this knowledge must encompass economic and social as well as technical factors. These factors must be incorporated into CARI's research strategy and into individual research projects. Likewise, verification of research recommendations

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1/ The strategy concept in this project incorporates efforts to achieve both macroeconomic national objectives as well as farm-family economic and social objectives.

should take place in real world conditions; adaptation of technology to resources available at farmers' level and to farm families' perceived priorities. This approach to incorporating social and economic factors into the research and technology transfer process is generally termed the farming systems research/extension (FSR/E) approach to agricultural development.

The first step in applying an FSR/E approach to CARI's program would be a survey of Liberian farming systems to identify the technical constraints to production and the social and economic parameters that would determine the feasibility of any proposed solution. These FSR/E survey results would then be incorporated into a general CARI strategy, departmental research programs and specific research projects. As the technical problems become better understood and innovations are adopted, socio-economic surveys will quantify the changes and update the data base and CARI's general research program will have to be modified.

An essential intermediary step in adapting research technology from the CARI station to producer locations will be adaptability testing of improved technologies at off-station sites in the priority agro-climatic zones selected for development. One such site, the existing agricultural station at Saye Dube, Grand Gedeh County, has been identified to represent the high rainfall zones which are extensive in southeastern Liberia. It will be converted to a research out-station.

As noted above, the general outline of a research strategy is already known. This strategy would pursue higher yields in present farming systems while at the same time devising a more productive alternative based on continuous cropping and high value crops. Fisheries and animal husbandry may also be important components though not enough is known about them at present to judge confidently. Given these general research goals, CARI's need for additional staff and facilities can be identified. These are presented in Appendix I and encompass all departments though the greatest requirements are in crop science, socio-economics and off-station research.

The tasks needed to implement an effective research program, thus, are numerous. However, the ongoing fiscal and economic crisis in Liberia makes any rapid expansion in CARI's budget impossible, at least over the next four to five years. In particular, the GOL's expected budgetary cuts will restrict CARI's ability to incur the additional recurrent cost of hiring more staff. Sixteen new positions have been designated by the design team as vital to be filled in the first half of the project. They are essential to initiating FSR/E and out-station testing, improving research administration, and undertaking the most promising research areas of increasing yields through varietal selection and breeding, developing continuous cropping systems and adapting high-value crops to traditional farming systems. In addition to these 16, ten more have been identified that should be filled by the end of the project making a total of 26 for the first ten years. An additional ten to these 26 have also been identified as being required for the long term staffing at CARI and may be filled when the GOL's fiscal position improves sufficiently to allow it to incur further recurrent costs. As the Financial Analysis (Annex F)

demonstrates, CARI can meet the additional recurrent cost burden of 16 new employees under its present budget or even with substantial budget cuts if it takes economizing measures in other areas. The full recurrent cost input of 26 new employees, however, will amount to nearly $1.0 million a year.

Given these recurrent costs and the additional costs of the project, will its economic returns make it justifiable? Estimating economic returns from research is highly problematic. However, one practical methodology is to calculate the economic benefits that would be needed to justify the project's economic cost and to judge the plausibility of such benefits being produced by the project. As the economic analysis demonstrates, a relatively small increment to the productivity of small farmer agriculture would justify the additional costs of the project. For example, a 10 percent opportunity cost for development capital in Liberia is considered an appropriate factor by the World Bank. With a 10 percent discount rate applied to project costs, an incremental 0.5 percent increase in the value of output after project year 10 from the rice, tubers, coffee and cocoa typically produced by smallholders is more than adequate to pay for the project (Annex E). This level of marginal output (adjusted for increases in rural population and current growth trends) appears to be a very modest target. Of course, growth in output is only possible if the technology generated by CARI is adapted to farmers' resources and is communicated to farmers through the extension liaison function and the extension system.

VIII OTIATING STATUS AND CONDITIONS AND COVENANTS

A. Negotiating Status

The design of the Phase II project was initiated in April 1984, with the arrival of the project design team from Purdue University. The design team prepared an initial design after consultations with the MOA and extensive discussions with CARI's staff. The Purdue team presented a summary of its findings and recommendations to the MOA and CARI. These findings and recommendations were the basis of the first draft of the Phase II project paper which was prepared by the USAID/Liberia staff. USAID circulated the draft to and discussed it with the MOA and CARI. USAID then prepared a second draft incorporating MOA and CARI comments as well as those of its own internal review and additional sections not included in the first draft. This new draft along with the proposed text of the Project Grant Agreement will be circulated to the MOA, CARI and the Ministry of Planning and Economic Affairs by August 27. Final negotiation and signing of the Grant Agreement is hoped for by August 31.

B. Conditions Precedent

1. Commitments after March 31, 1985. Prior to commitments under the Grant after March 31, 1985, or to the issuance by AID of documentation pursuant to which such commitments will be made, for other than on-going construction and training activities, the Ministry of Agriculture (MOA) shall, except as the Parties may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID:

a. Copies of memoranda of understanding between CARI and the Bong County Agricultural Development Project, Lofa County Development Project and Nimba County Development Project covering their respective roles in off-station research and dissemination of improved varieties and technologies;

b. Evidence that the MOA has elevated the one-man socio-economic research unit to departmental level and added two new staff professionals; and

c. Evidence that the MOA has established procedures for the submission, review and approval of research proposals by CARI's staff.

2. Commitments after June 30, 1985. Prior to commitments under the Grant after June 30, 1985, or to the issuance by AID of documentation pursuant to which such commitments will be made, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID evidence that the MOA and CARI have submitted a draft agricultural research strategy to the Technical Committee of the Agricultural Research Council for its approval which 1) is consistent with Liberia's goals for national economic development, 2) is oriented towards Liberia's small farmers, 3) is socio-economically sound, 4) covers agronomic practices as well as research on plant varieties, and 5) includes mechanisms for coordinated, inter-disciplinary research.

3. Disbursement for the Saye Dube Agricultural Station. Prior to the first disbursement under the Grant or to the issuance by AID of documentation pursuant to which disbursement will be made for the Saye Dube Agricultural Station, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID evidence that it has transferred the cost of operating this station from the Grantee's budget to CARI's budget.

4. Disbursement for Commodities. Prior to the first disbursement under the Grant for the purchase of commodities other than those to be used directly by the technical assistance team, or to the issuance by AID of documentation pursuant to which such disbursement will be made, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID evidence that: 1) a system of inventory control has been established for CARI's equipment and supplies, and 2) an acceptable system of routine maintenance has been established for all of CARI's motor vehicles and machinery, including a system for stocking and reordering spare parts.

5. Issuance of Project Implementation Orders/Participants for Long-Term Training. Prior to the first issuance of a Project Implementation Order/Participant (PIO/P) for long-term training under the Grant, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to AID, in form and substance satisfactory to AID, a copy of a contract to be executed between the Grantee and all long-term trainees which obliges them to work for CARI upon completion of such training for a period of two years for each year of training received.

C. Special Covenants

1. The Parties agree to establish an evaluation program as part of the Project. Except as the Parties otherwise agree in writing, the program will include, during the implementation of the Project and at one or more points thereafter: (a) an evaluation of the progress toward the objectives of the Project: (b) identification and evaluation of problem areas or constraints that may inhibit such attainment; (c) assessment of how such information may be used to help overcome such problems; and, (d) evaluation, to the degree feasible, of the overall development impact of the Project.

2. The Grantee agrees to create new staff positions called for in Annex I to this Agreement and to fill these with qualified personnel in a timely fashion.

3. CARI agrees to provide housing, utilities, office space, secretarial support and vehicle maintenance at Suakoko for the project's technical assistance team.

4. The CARI and the Ministry of Agriculture covenant to implement the following cost savings:

- Removal of the Marine Research Unit from the CARI budget

- Reduction of CARI's personnel expenditures by ten percent (based on the 1982-83 budget) by removing unproductive workers from CARI's payroll and eliminating all pension payments from CARI's budget and transferring that obligation to the GOL's general budget

- Reduction of CARI's support costs per professional by 15 percent (based on the 1982-83 CARI budget)

5. The Grantee agrees to assign ten MOA extension staff to CARI for no less than one year for training in subject matters recommended by the project's technical assistance team.

6. The MOA and CARI covenant to develop and agree upon a plan within six months of the signing of this agreement on the disposition of the Extension Liaison Unit and the respective roles and responsibilities of the MOA and CARI for the funding, staffing and operation of the unit.

7. The GOL covenants to adopt by December 1985 through its Agricultural Research Council and its Technical Committee a national agricultural research strategy based upon a draft prepared by CARI and the MOA. The GOL also covenants that the Agricultural Research Council or its Technical Committee will review this strategy annually.

PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK

Life of Project: 10 years
From FY 84 to FY 94
Total U.S. Funding $19,990,000

Project Title & Number: Agricultural Research and Extension Project, Phase II

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	**Measures of Goal Achievement:**		**Assumptions for achieving goal targets:**
To raise rural incomes and increase Liberia's food self-reliance	Value of agricultural production increases by 0.5% per annum over growth rate starting by year 10	MOA records/statistics	- Continued favorable market prices - both domestic and international - Favorable climatic conditions - Political stability
Project Purpose:	Conditions that will indicate purpose has been achieved: End of project status.		Assumptions for achieving purpose:
To develop the institutional capacity of CARI to identify the needs of subsistence farmers to generate improved technologies responsive to these needs through adaptive research and to communicate these technologies to institutions which can extend them to farmers	- Ongoing program of farming systems research established - Improved varieties of rice, cereals, roots and tubers identified - Improved research administration - Development of a strong extension liaison section	CARI records	- Continuing GOL financial support to CARI - Continued availability of qualified counterparts for technical assistance staff
Outputs:	Magnitude of Outputs		Assumptions for achieving outputs:
Crop Science long-term training technical assistance	Crop Science 12 trainees 14 years of technical assistance	CARI records AID records	- AID funds available - GOL counterpart funds available
Land and Water Resources long-term training technical assistance	Land and Water Resources 7 long-term trainees 4 years of technical assistance		
Plant Protection new staff laboratory technical assistance	Plant Protection 2 new staff 1 laboratory 5 years of technical assistance		

ANNEX V

Animal Science long-term training new staff technical assistance	**Animal Science** 2 trainees 2 new staff 4 years of technical assistance
Agricultural Engineering new staff long-term training technical assistance	**Agricultural Engineering** 2 new staff 2 trainees 4 years of technical assistance
Off-Station Research Station Saye Dube On-farm trials	**Off-Station Research** 1 station 100 on-farm sites
Department of Socio-Economic Research long-term training technical assistance new hires	**Department of Socio-Economic Research** 5 trainees 10 years of technical assistance 5 new hires
Extension Liaison Office technical assistance	**Extension Liaison Office** 8 years of technical assistance

Inputs:		Implementation Target (Type and Quantity)	Assumptions for providing Inputs:
AID			
Technical Assistance Financing	7565		
Participant Training Financing	2498		
Construction Financing	1153		
TOTAL	19981		
GOL			
1. Existing CARI Operations			
Personnel	10600		
Support Costs	5800		
Equipment	2300		
Inflation	3300		
2. Project Incremental Costs			
Personnel	1228		
Support	1802		
Equipment	400		
Construction	1150		
Inflation	1046		
3. Saye Dube			
Outstations	2670		
Inflation	335		
TOTAL	29631		

TECHNICAL ANALYSIS

I. Technical Constraints to Liberian Small Holder Agriculture

The small holder is the central focus of Liberia's agricultural development strategy. With the exception of a few industrial-scale plantations, virtually all of Liberia's 150,000 farm units are small-holder households. Diversifying and expanding agricultural production to meet Liberia's food needs and increase export earnings will largely depend on these small holders. Likewise, raising the income of these farmers will have the greatest and most direct impact on the problem of poverty and maldistribution of income in Liberia.

Virtually all small holders grow rice, the nation's staple food. Typically each household grows 3.5 acres of upland rice yielding an average 1,100 lbs. per acre. This barely meets the subsistence requirement of the average farm household which contains six members. A few small holders grow swamp rice in lieu of or in addition to upland rice. Often, swamp rice is grown for sale, or insurance against the "hungry season" preceding the upland rice harvest. While average yields for swamp rice (1500 lbs. per acre) are higher than for upland and potential yields also higher, total acreage is small and labor requirements are greater per acre.

Cassava is the second most important crop in Liberia, and is sometimes used as a staple crop during the "hungry season" before the rice crop is harvested. Cassava is typically "stored" in the ground to meet emergencies and very small quantities are sold for cash.

The small holder may also raise vegetables (often intercropped with rice), roots and tubers, legumes, tree crops and livestock. While vegetables and other food crops are usually raised for household consumption, there is often a surplus which can be marketed. In many farms, especially in the more developed central and northern counties, cocoa and coffee are grown for cash. Acreages usually do not exceed 3 acres per farm. The role of livestock (mostly small ruminants) in the small holder system is not well understood but it is believed to serve principally as a means of holding wealth which can be "cashed in" when the need arises. In a few areas fish ponds have been introduced, their production usually being sold for cash income.

Liberia's agricultural development strategy envisions transforming the small holder sector from semi-subsistence to commercial agriculture, producing more food for domestic consumption and cash crops for export. Increasing, diversifying and commercializing small holder production will face many constraints. These include lack of access to markets, credit and

technology. Social considerations such as the farmer's preference for meeting household food requirements before earning cash income are also important. However, the most fundamental constraint to production is the very low productivity of the small farmer. His or her yields are low and the acreage cultivated is small.

The factors that limit the productivity of Liberian farmers largely derive from the characteristics of Liberia's soils and climate and lack of any mechanization, even oxen. As in many humid tropical areas, Liberian soils are thin, fragile and poor in nutrients. Except for swamps and some bottom land, few Liberian soils can support more than one or two crops of rice or other field crops before being exhausted. Most land is rolling or steeply sloped. Moreover, soils are prone to rapid erosion, leaching and laterization if left exposed. Also, weeds become a major problem in fields that have been cleared for more than a year. In response, the Liberian farmer, like farmers in the tropics throughout the world, have adopted a technology of slash-and-burn or bush fallow in which a field is cleared, used for one or two years and left to revert to bush for 7 to 12 years to replenish nutrient supplies.

However, this system requires substantial labor input to clear new fields every year. This effectively places an upward limit on the amount of land that any household can cultivate to about 5 acres. Human labor is the only power available. At the same time, the labor constraint that prevents more land from being cleared means that labor will be largely under-utilized during the growing season until harvest time when labor again becomes a constraint. Finally, yields are low compared to countries where modern inputs and varieties are used.

II. Research Needs

New technologies are needed that will raise yields or increase the area the farmer can cultivate or both. Attempts have been made to import directly more productive technologies from other areas. Since the 1950's, Asian-style rice culture or "swamp rice," intended to increase yield on small scale units, has received major development attention and funds. More recently, large outlays have been devoted to developing large, tractor-mechanized upland and irrigated rice farms. To a greater or lesser extent all of these development efforts failed for the same basic reason: they all represented attempts to transfer technology directly from elsewhere without determining whether it could be adapted to local conditions.

The costs of fertilizer and other production inputs for swamp rice are very high in Liberia and Liberian farmers have not been able to obtain favorable yield responses. Few high yielding varieties are adapted to Liberia and even these do not yield near their potential due to poor water and general cultural techniques. Therefore, even with subsidized fertilizer and other inputs many project farmers have abandoned the use of high input technology after one season. Also, swamp rice units have been limited to uneconomically small sizes because no suitable tools are

available for effectively mechanizing production by households.

In response to these failures CARI was established with a mandate to do applied and adaptive research, i.e., research to provide practical solutions to pressing agricultural development problems by adapting existing knowledge and technology to local conditions. This assumes that technologies exist which can be applied to Liberia's agricultural problems, but that successful adaptation will require careful screening, analysis, modification, and testing to insure adaptation to Liberia's unique environment and resources.

Over the short-term (within 5-10 years), the opportunities for identifying, adapting and extending improved technologies will probably be limited to increasing yields in existing farm enterprises with higher yielding varieties and improved cultural practices. There may also be opportunities to introduce new cash crops or enterprises.

Identifying varieties with superior yields in existing farming conditions is the most promising means of increasing production because it poses the least disruption to the existing farming system and thus is the most readily acceptable to farmers. Varieties that require fertilizers or other high technology inputs will be harder to extend because of the limited capital resources and management experience most farmers have and lack of an institutional infrastructure to supply these inputs. Superior varieties should be developed not only for all food and tree crops. Improved cultural practices may also be readily acceptable for field and tree crops if these do not entail substantial investments and can save labor during peak demand periods of field preparation and harvesting. Traditional management practices for livestock are not well documented but are believed to be minimal. The greatest potential for improvement of livestock in the short-run is probably better disease control.

Over the longer-term, the labor constraint that is paramount in limiting the acreage under cultivation will undoubtedly have to be addressed by a system of more or less continuous cultivation on permanent fields. Not only will this free the farmer from the constraint that limits his/her field to the area that can be cleared by planting time, but will also allow improvements to be made to the land that might permit some cultural processes to be mechanized. Animal traction would become a possibility.

The requirements of a continuous cultivation system in Liberia are not known but would undoubtedly include a crop rotation system alternating field crops with leguminous crops or trees, pasture, or a green manure. Likewise, soil management technologies to prevent compaction, leaching and erosion will have to be closely examined as will methods for controlling weeds. Livestock production is economically complementary to continuous cropping systems, but this will take time to develop due to the lack of tradition with livestock production.

However successful a continuous cropping might be, field crops do not hold as much potential as tree crops. Liberia's climate, topography and soils are much more suitable for cocoa, coffee, rubber, oil palm, tropical fruits and nuts than for rice, maize or vegetables. Farm budget data indicates that the returns to labor for tree crops under current relative prices are greater than for field crops and, in particular, greater than that for rice by a factor of ten or more. Thus, while farmers may continue to grow rice and food crops for household consumption because of social preference, tree crops will undoubtedly be an element in most small holder farming systems that successfully commercialize. The introduction of new tree crops and the development of an integrated system of tree and field crops must be a long-range goal.

III. Farming Systems Approach

An agricultural research strategy for Liberia must investigate not only the technical constraints that soils, climate and existing cultural practices pose to agricultural production but also the economic and social factors that affect the farming system. Technologies developed must be economically and socially as well as technically feasible. Moreover, given the complex interrelation of various enterprises within the farm, technologies must be assessed within the context of the entire farm to see if changes in one enterprise will be compatible with the other components of the farming system.

This approach to placing agricultural research within the context of the farm has been generally termed "farming systems research" (FSR). While this term has taken on various meanings and doctrines, its use in the case of CARI refers to two essential tasks in CARI's research process. First, systematic and comprehensive data on the social and economic as well as the technical characteristics of small holder systems are needed to provide the basis for identifying research opportunities and developing a research strategy. Given the limited financial and human resources available to CARI, effective agricultural research must be carefully planned and focussed on priority topics that hold the promise of improved technologies that will be adopted by a significant portion of small farmers. At the same time, a research strategy must be flexible to take into account the evolving social and economic context in which the small farmer produces. Second, a potential innovation, once identified, must be tested on the farm to verify its feasibility in real world conditions and its compatibility with the farming system as a whole.

The integration of socio-economic factors into the formulation and direction of a research strategy will require CARI to assess and analyze socio-economic data on various farming systems, paying attention to social (e.g., custom) as well as technical or agro-climatic differences between different systems.* This information is then "fed" into the research

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* This data must be continually updated to keep abreast of social and economic changes within the small holder sector.

planning process through the office of the CARI Director and Research Coordinator. In formulating research plans, an interdisciplinary group including socio-economic as well as technical experts would devise research program strategies based on the best understanding of where opportunities for technical innovations lie and which technologies are most likely to be adopted by farmers. Research should then be undertaken through a project approach by which research departments coordinate their efforts at solving particular technical problems rather than each discipline pursuing an independent line of inquiry.**

The second task, out-station research is necessary because the Suakoko area represents only one of several agro-climatic zones.

The third task, on-farm trials, must be carried out by an interdisciplinary team including not only agronomists (or animal scientists if relevant) but also economists and sociologists to assess the technology's compatibility with local custom and other farm enterprises and also examine the net economic impact that the innovation will have on the farm household.

IV. CARI's Institutional Requirements

A. Research Departments

By the end of the Phase 1 project, CARI will have qualified staff in all research departments capable of undertaking at least some adaptive research. However, all departments require additional assistance, either in terms of upgrading the education and professional skills of present staff members or adding additional staff with different specializations. Requirements for some 26 new positions over the next ten years have been identified along with long-term training requirements for some present staff members. Appendix I identifies these new staff and training requirements as well as the general line of research in each department.

Given the fiscal constraints that CARI will likely be under during at least the next 3-4 years, priorities must be set in allocating new staff among research areas. From present understanding of the small holder sector, the short-term priority of research must be improving yields of crops, principally rice, roots/tubers and trees. Short-term objectives in livestock, fisheries and mechanization, including draft animals are of secondary importance. Among long-term objectives, field and tree crops remain paramount, but strategies for developing continuous cropping or crop rotation systems will require close collaboration among the Crop Science, Lands and Water and Plant Protection Department (with some input from agricultural engineering as well).

** Research plans must continually be revised as additional technical and socio-economic data allow better understanding of technological opportunities.

Among these three priority departments, staff capabilities by the end of the Phase I project should be strong, particularly in soil fertility and rice agronomy. Additional staff will be needed in root/tuber, vegetables and tree crops. Within the areas of secondary importance, which require additional staff, small ruminants and animal traction research is probably the most promising. This prioritization of staff needs must be continually re-examined in the light of CARI's evolving research strategy and resource availability.

B. Socio-Economic Research

A mainstay of farming systems research is a comprehensive understanding of the social and economic elements of the farming system. CARI must collect, analyze and structure such data so as to make it useful in research planning and evaluation. To do this, it will require a full-fledged Socio-Economic Department. This department will consist of agricultural economists, rural sociologists and field enumerators. Agronomists, animal scientists and other technical experts should be called on to participate as needed in analyzing current practices. A detailed program for collecting such data is presented in Section G of Appendix I to this analysis.

In addition to collecting and analyzing socio-economic data, the department should participate directly in the process of formulating research plans and reviewing research results. Likewise, the department should participate directly in on-farm research (discussed below).

C. Research Administration

The discussion of Liberia's research needs above highlights two essential tasks in administering CARI's research program: a) careful planning to focus research on the most relevant and promising topics and b) coordination that will integrate the work of several departments in solving particular problems. Responsibility for these tasks will fall principally to the CARI Director and the Research Coordinator.

The tasks of planning and coordination are largely inseparable and should be integrated in a research administration process. The first step in this process must be the formulation of a research strategy. This strategy should outline the areas where research holds the most promise in both the short and long terms to fulfill both producer and national objectives, set priority topics for research and establish goals with specific verifiable benchmarks. The strategy should encompass a sufficiently long time frame that significant progress can be made (e.g., five years). However, this strategy must be reviewed periodically, possibly annually, to re-examine its assumptions in light of the additional technical, social and economic data generated and changing economic and social circumstances. The Director, Research Coordinator and Socio-Economic Officer are best suited to draft such a strategy though it should be reviewed by CARI's professional staff and approved by the Technical Committee.

Once approved, this strategy could serve as the basis for research programs to be developed by each department. Programs might be multi-year but should contain a workplan for the coming year and should be revised and reviewed annually. After being reviewed within the department, the program would then be reviewed and approved by the Research Coordinator with the assistance of a committee that would include, as a minimum, the socio-economic officer and extension liaison officer. This review will concentrate on the relevance of the proposed program to CARI's strategy and insure that the department's work is coordinated with that of other disciplines.

Finally, each department will prepare detailed proposals for specific research projects to be undertaken during the year. The CARI Director and the Research Coordinator should head a committee that reviews and approves each proposal. This committee should include not only the socio-economic officer but also a research scientist from another department and a statistician. The review should consider the relevance of the proposal to the approved departmental research program and the soundness of the methodology and research design. CARI should also adopt a standard format for proposals and procedures for distributing and reviewing them within the department and by the Research Coordinator's office.

D. Off-Station Research

Two forms of off-station research are needed by CARI. First is research conducted at an outstation in a different agro-climatic zone. Second is on-farm trials.

Outstation research is necessary because the Suakoko station represents only one of several agro-climatic zones. In particular, Suakoko's rainfall is markedly lower (70 inches) than for most other areas of Liberia. Also, rainfall patterns vary with some areas having two rainy "seasons" rather than one. The agricultural facilities at Saye Dube, Grand Gedeh County, have been selected as CARI's outstation. The Saye Dube area is more representative of Southeastern Liberia which has a wetter climate than that of Suakoko and the northwestern areas. Other small outstation sites will be sought in other zones to verify results under the various agro-climatic conditions.

To test the applicability of a proposed technology to farmers' resources requires on-farm testing. The on-farm trials will have several objectives: a) verify technical feasibility in the more realistic setting and management conditions of a farmer's field, b) assess the social acceptability and impact of the technology as well as its impact on other elements of the farming system and c) calculate the financial and economic cost and benefits to estimate the incentive for adopting the technology.

The responsibility for conducting extensive on-farm trials is with the extension service. Initially there will be "pilot" on-farm trials conducted by CARI interdisciplinary teams to cover the three priority counties. Other counties will be added on a time phased basis according to priority. The CARI FSR/E team will teach extension field personnel in each

of the counties how to conduct on-farm trials. Thereafter, the CARI FSR/E team will monitor on-farm trials on a random basis to verify that techniques are being implemented properly. The Socio-Economic Department will be responsible for surveys following the on-farm trials to quantify adoption and evaluate socio-economic factors and farm family responses to the new technology.

On-farm trials must be monitored by an inter-disciplinary team capable of examining technical, social and economic factors. To supervise the trials, an inter-disciplinary Farming Systems Research Committee should be formed, headed by an agronomist but including an economist and sociologist as well as other technical officers. The committee will be responsible for developing an annual program for on-farm tests as well as review the design and methodology of tests, monitor the progress of the teams which actually conducts the tests and review the testing results. The extension liaison officer should sit on the FSR Committee and arrange the selection of participating farmers with the MOA extension service and ADP's.

V. Impact of Continuous Cropping on Livestock Production and Animal Traction

This section is a special component of the technical analysis added to explain some of the technical factors involved in continuous cropping systems as well as the importance of animal traction in either traditional or continuous cropping systems.

The proposal for increased continuous cropping and gradual cessation of slash and burn cropping systems will require increased production of legumes, particularly perennial legume and grass forages, as soil building crops suitable for lateritic soils. When forage crops are introduced into a rotation, ruminant livestock are normally introduced in the farming system to convert these forages into marketable products to generate the economic returns to render the soil building process viable.

Annual legumes such as pulses, cowpeas, etc., are not soil building crops as they improve nitrogen levels only marginally and lack the year around vegetative cover required to prevent deterioration of the laterites; a process which occurs when the soils are exposed to sun, rain and heat during the non-crop season. Annual edible legumes can be used profitably, however, when intercropped with cereals and are effective in reducing soil deterioration if not grown for more than a year or two.

The foundation of the productive agriculture in Europe and the United States in the cereal-producing areas prior to the era of extensive use of fertilizer and pesticides was mixed crop/livestock agriculture, as the two enterprises were complementary in soil building. Mixed crop/livestock farming is still the most appropriate system for long term maintenance of soil productivity in most LDC's. The large quantities of fertilizer required for maintenance of fertility under continuous cropping systems with annual crops are of questionable profitability at this stage of development in Liberia, are expensive, and present a formidable risk to be taken by small subsistence farmers. Further, the lateric soils of Liberia

would deteriorate even if fertilizer was replaced annually under continuous row crop cultivation as the chemical properties of laterites are not stable when the soil is left exposed.

The transition to continuous cropping in Liberia will be very gradual. Extensive research will be required to develop production systems that will maintain soil productivity as well as being adapted to the economic and social goals of farm families. Thus, there is no urgency for an intensive livestock production research program. The project designers recognized, however, that the small livestock enterprises that do exist have potential for considerable increase in efficiency and that there is an attractive market for a large increase in production of meat and other animal products. Resources to improve livestock production efficiency have been selectively proposed commensurate with Liberia's stage of development.

The evaluations must address the rate of progress being achieved in the search for viable and verified continuous cropping systems to identify and recommend the project changes required in the livestock research component.

A clarification is required to differentiate the sharp difference in livestock production under mixed crop/livestock systems and that of the open range/transhumant livestock production systems of the Sahel, the Somalia/Sudan/Kenya triangle and the Botswana area. AID and other donor experience with livestock production projects in those low rainfall areas where land is "in-the-commons", have produced very disappointing results. Such conditions do not prevail in Liberia where rainfall levels are higher and land access is largely controlled by transitional social systems and/or hierarchy. Potential for acceptable financial returns from livestock does exist.

The final and most important rationale for support to livestock production relates to the need for an increase in animal traction.

Where animal traction is well developed, area cultivated per family has increased by from 50-200%. Animal mechanization could increase the impact of this project substantially. Availability of farm family labor establishes an absolute limit on the area that can be farmed when cultivation is entirely by hand. This constraint is enormously underestimated by planners responsible for assisting Africa liberate itself from perpetual borderline subsistence food levels. Except for highly localized areas of dense population such as Rwanda and Burundi, land availability is extensive in Africa generally, as it is specifically in Liberia.

Impressive progress has been made in some West African countries in expanding adoption of animal traction. In one large area of Southeast Mali, up to 80% of the farmers cultivate with oxen. In the Gambia, almost 40% of the farmers do the same. Both countries have some N'dama oxen as the tsetse fly occurs in both. Further, Colorado State has modified an over-drawn weed cultivator in Gambia that is much more efficient than previous models and has reduced women's work considerably. The constraints

are not intractable but research is required to understand the range of issues which must be addressed in Liberia and to develop a program attractive to farmers. Lessons learned from these other countries will be studied under this project to assist in this effort.

ANNEX C

INSTITUTIONAL AND ADMINISTRATIVE ANALYSIS

I. General Administration

In 1980, CARI was named the institution responsible for all government funded agricultural research in Liberia. At that time it became a semi-autonomous entity in the Ministry of Agriculture. This status gave CARI a line item budget of its own with freedom of allocating resources and managing day-to-day operations.

The Minister is responsible for research policy as recommended by the Agricultural Research Council. This Council is chaired by the Minister or a designated Deputy and consists of both government and private members. Reporting to the Council is the Technical Committee. Its chairman is the Deputy Minister of Agriculture for Technical Affairs, the Director of CARI is secretary, and the membership consists of the CARI Research Coordinator and representatives of the Agricultural Research Council at the technical level. All CARI senior research officers are ex-officio members.

The Technical Committee is supposed to meet quarterly but in actuality its meetings have been less frequent. The Council has apparently never met. These two entities function as a Board of Directors to CARI.

Research units at CARI operate under a Research Coordinator responsible to the Director. Also reporting to the Director is an Extension Training Liaison Officer and the Economic and Social Analysis Officer (See Chart C1).

An external review team in 1983 suggested a modified organizational structure (See Chart 2). This assigns several service functions to the Extension Liaison Officer and identifies external agencies with which liaison should be established. It also specifies areas of responsibility for the Administrative Officer.

The Design Team questions the Vegetative and Fish Propagation functions of CARI. These non-research activities more appropriately belong to other agencies, such as the Small Holders Rice Seed Project or Agriculture Development Projects. Foundation stock and breeders seed need to be maintained and increased at CARI.

Likewise, the Team feels that an Analytical Laboratory installed as a service unit under the Research Coordinator is less functional than similar laboratories located in departments, which collectively, would be able to perform the necessary services, and do so more efficiently. We agree that the Socio-Economic unit should assume Departmental status.

II. Research Administration

A formalized procedure is in effect for preparation and submission of research projects. These are prepared by the researcher, endorsed by the Department Head and submitted to the Research Coordinator for approval. The system as it now works appears to be more a bookkeeping exercise in recording and compiling projects for the archives, rather than a critical appraisal of research and a conduit for the allocation of research resources.

Projects do not undergo peer review at any time. Indeed there is no feedback to the project leader from the administration concerning the merit of the proposal, its priority status, the degree of support it might receive, etc.

It appears that funds are not allocated to the Department Head to implement research activities in his administrative unit. Every expenditure, however slight, must be approved on an individual basis by the Research Coordinator and the Administrative Officer. Under this system the Department Head can exert little administrative direction.

This lack of discretionary departmental funding seems to be a source of disaffection among the CARI staff. It is said to be responsible for operational inefficiencies, delays in implementation of studies and even the total loss of experiments. While its magnitude is difficult to gauge, the problem is certainly real in the minds of the staff. The administration's position is that allocation of resources from the Ministry is so sporadic and subject to delay that tight control in fiscal matters is essential. Top priority is given to meeting the payroll, and secondarily the maintenance of utilities such as electricity and water. In fact, these goals appear to have been reached.

It is clear that the situation is a complex one with each protagonist having valid arguments. But for a department to be effective it must have some authority to allocate funds. Procedures must be initiated to make this possible.

A notable lack of internal communication and coordination is evident. Staff meetings seem to be held very infrequently. No policy exists for presenting seminars, for reporting on research results, for holding the equivalent of informal "journal clubs," etc. Despite the small size of the professional staff and the physical compactness of the unit, it appears that individuals work in a vacuum of sorts. The desire to expand communications was articulated repeatedly. This should be easy to achieve with little or no cost. The administration must take the initiative and demonstrate that it considers effective communication to be vital. Doing so will have a positive impact on morale. It is essential that provision be made for conference and seminar rooms. At present it is necessary to improvise space in the library (which is tiny), or in the corridors when a meeting is convened.

III. Extension Liaison

CARI has accomplished meaningful research in some areas, but thus far researchers have not identified the problems of the small farmer. The attitude around the country is "CARI may do research but no one ever hears about it." It is vital to the future of CARI that research information be available to farmers in all parts of the country. This research must, moreover, be relevant to the user. Research scientists at CARI have become involved in a limited way with the Agricultural Development Projects. They have conducted training sessions and occasionally responded to specific problems. There is a need however to institutionalize extension liaison at CARI to assure that research findings are transmitted to the farmer routinely and rapidly and in a form usable to the small farmer. The constraints are:

-- Transportation - Poor roads make travel difficult and time consuming.

-- Communications - At present CARI cannot even communicate via radio with the ADP's.

-- Lack of data concerning problems of the small farmer - There is general lack of information on technical, economic and social problems which influence the small farmers' ability to produce. Thus, though innovations are developed, they may not be adopted, or if adopted, may not be useful. For example, exotic swine placed on small farms performed well under improved management conditions, but when farmers were unable to feed them properly, because feed was unavailable or they lacked money to buy feed, the breeds failed.

-- Nature of extension service - Many workers are poorly trained and lack logistical support.

Discussions with BCADP, LCADP and NCRDP personnel indicated a willingness to cooperate with CARI in research and dissemination of research findings. It was also pointed out that these projects are scheduled to end before the midway point of Phase II leaving the MOA the only extension agency left. However, it is likely the ADP's will continue to function with funding from other donors.

Training of Extension personnel is urgent, but will not be possible for all extension workers. Selected workers at key locations should be identified for training. Initially, too, much of the extension effect may need to be focused on data collection. This provides an opportunity for one more interaction to identify problems, opportunities for change.

The potential for radio extension progress may exist with the Liberian Rural Communication Network and if possible linkages need to be established with them.

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It is difficult to diffuse information through a single culture. In Liberia, at least 16 individual cultures exist. Extension policy must be planned with this in mind. Failure to account for culture differences may doom an otherwise useful innovation. If such constraints are accounted for during research planning the practice may be presented in an acceptable way and adopted. This is a vital role of extension.

To develop an effective extension program, the following is recommended:

1. Request the Ministry of Agriculture to assign at least one Extension Specialist per Department at CARI for one year to gain experience in applied research. Working with the CARI staff will develop the extension workers capacity for applied research and sharpen his problems solving abilities. When research results becomes available, the specialists will take this information throughout the country with a clear understanding of how it was developed and how it might be used. It should be noted, however, that CARI has neither the resources, personnel or responsibility to discharge the complete extension function. The determination of the respective responsibilities of CARI and the MOA's Department of Rural Development and Extension for the extension liaison function will be negotiated prior to the arrival of the technical assistance team.

2. Hold specialized annual training sessions of 3-4 days to train ADP extension workers in problem identification and solution.

3. Conduct specialized annual training sessions of 3-4 days to train selected agents, focusing on 1-2 departments, with a maximum of 50 people per year.

4. Schedule annual field days or demonstration days for farmers to show research results. Initially these would be held at CARI but eventually they can be held at other locations throughout the country.

5. Develop a CARI newsletter consisting of abstracts of annual reports presented in terms farmers can understand. These newsletters will be distributed to extension workers in various agencies and interested farmers.

6. Initiate mass media (radio) broadcasts featuring CARI research.

7. Two-way radio communication with the ADP's must be installed.

To function effectively as a research institution CARI must identify problems of the Liberian farmer and deliver solutions in a more efficient manner than has been done in the past. To do this, expertise from many other organizations should be utilized, and in turn the expertise of CARI personnel can be made available to the cooperating institution. In many instances CARI has made informal (person to person) agreements with ADP's and other institutions. All the professional staff at CARI bear a responsibility to build these linkages but it is the special

Oesponsibility of the Director, Extension Liaison Officer and the Research Coordinator to build into formal working agreements such as a "Memorandum of Understanding."

Such formal relationships are essential with LCADP, NCRDP, the University of Liberia and BCADP. The Rural Development Institute, Cuttington College, Liberia Rural Radio Network, Department of Technical Affairs of the MOA, Information Section of MOA, Peace Corps, PfP, and FAO are other institutions that merit linkage with CARI. A list of services that CARI might provide and services that might be provided to CARI is shown in Table 1.

To establish better radio communications with the ADP's, it is only necessary to supply additional crystals to the existing radio. The completion of a CARI guest house would facilitate visits by University of Liberia faculty and ADP workers. It is suggested that an annual meeting with the faculty of the University of Liberia be held at CARI and Monrovia on an alternating basis to review the work of both institutions.

A small fund should be established to be used each year for collaborative research projects especially with faculty of the University of Liberia (USCAF) and workers at ADP's. Such funds would be awarded through competetive research proposals evaluated by a committee headed by the CARI Research Coordinator and consisting of research workers at CARI and the University of Liberia. This linkage with the University of Liberia is especially desirable because of the complementary nature of work at the two institutions.

Table C-1 lists some of the linkages that CARI should develop with other agricultural institutions in Liberia.

IV. General Support

CARI has an Acting Director. Persons in an "acting" capacity are understandably more tentative in decision making and in setting policy guidelines than a full Director. The Institute needs the stability of a Director, and a permanent one should be appointed as soon as possible.

The administration appears to be served by well qualified people at key positions. Most administrators are young, and, though lacking in experience, are generally well trained and motivated. The Administrative Officer needs a more effective support staff. He is responsible for payroll, personnel and all physical facilities. The burden of virtually every decision rests directly on him; the ability to delegate would substantially streamline the operation. Department heads on the other hand are given must less responsibility and authority than they are capable of handling.

The CARI support units, including laborers and technicians, appear to be greatly overstaffed in some areas. Care must be taken to ensure efficient staffing when filling positions which have been vacated. In some cases normal attrition might be allowed to proceed until reasonable levels are reached. Data on attrition rates should be collected to assist in making personnel projections.

Some employees have a hazy perception of their duties and responsibilities. A job description should be prepared for every position, professional and support, and a copy placed on file. This should be written in terms broad enough to allow for latitude of action but specific enough to be meaningful to the employee. Avoid severe restrictions such as "tractor drivers" which would limit work to that one specific activity. When drawing up a job description for an occupied position, the employee should participate in the process.

Equipment maintenance is always a problem in areas far removed from spare parts and professional servicing. CARI has recognized this and appears to have attracted capable Liberians and expatriates to work on maintenance. But severe problems persist. Too few people are adequately trained and the others are overburdened. Untrained operators add to the problem by taking improper care of equipment and ignoring preventive maintenance procedures. Implements of a variety of makes and models have been acquired which may not be interchangeable or complementary and this compounds the problem.

Much more training of mechanics is required. A technician is needed to service laboratory instruments. A more comprehensive spare parts inventory must be built up and an effective inventory accounting system established. A good beginning has been made in the above areas. With effort these difficulties can be surmounted in the next few years.

The CARI infrastructure has received much attention since Phase I began. Six new houses were built for the technical assistance staff. This is in addition to 29 existing houses occupied by Liberian staff and some other expatriates. It is unfortunate that the new houses are physically separated from the older structures, because it has inhibited personal interaction. To accommodate new professional staff at least 25 houses will have to be built over the next ten years.

A WARDA guest house, nearly completed, stands vacant, with a capacity for 12 occupants, and dining facilities. It should be completed, under an agreement with WARDA, and shared for guests of both institutions.

Three research buildings are under construction. These include (1) an analytical laboratory, (2) a veterinary science clinic and laboratory, and (3) a crop science building. An office building and conference facility has to be high on the priority list of new construction. A greenhouse, propagation house, and screen houses for plant protection work are essential. Equipment to install in the propagation house is on hand but construction of the building itself has been delayed. Maintenance and storage buildings are badly needed.

CARI is desperately in need of infrastructure development for its personnel. A new school building must be constructed to replace the inadequate facilities now being used if the Institute is going to be involved in schooling. A social center with recreational provisions would do much to create a sense of unity in the group. Such "quality of life" considerations are essential to insure the stability of a team of young productive, talented professionals.

The water supply is adequate, coming from a nearby reservoir. But the delivery system needs to be upgraded. Water is shut off each day for several hours and laboratories are not properly supplied. Power is furnished by a diesel generator. Its operation, too, is sporadic.

Communication is in need of attention. No telephone service exists with the outside. A radio is used to contact Monrovia. There is similar lack of an internal phone network.

Transportation is quite adequate. Each expatriate has a vehicle for official use. The CARI professional staff seems to be provided for as well. Fuel is costly, and often in short supply. Vehicle repair and servicing needs constant attention. If outstation work is to increase it will place an additional burden on vehicles and the cost of operating them.

A number of mini computers should be installed for handling such administrative matters as payroll, inventory and other record-keeping. They are also needed for research data processing and data analysis. If a single computer model is purchased software can be more efficiently used, and back-up instruments will be available in case of breakdown. Computers need to be provided with an emergency Uninterrupted Power Source unit and a transformer to compensate for unreliable local power service.

V. USAID/Liberia

The USAID Agricultural Economist will be the CARI Project Manager and will be assisted by other Agricultural and Rural Development Office staff, the USAID Controller, the USAID Engineer and other Mission staff, as well as by REDSO/WCA regional specialists in relevant areas.

The Project Manager will have the principal responsibility for project monitoring. USAID will convene quarterly internal reviews by the Mission Project Committee.

The Mission will also develop and execute contracts as needed for locally supplied inputs. The Mission's Engineer will review construction plans and monitor construction activities.

FINANCIAL ANALYSIS

I. Introduction

The principal issue of financial viability facing the Agricultural Research and Extension II Project is the GOL's ability to meet the recurrent costs of expanding CARI's staff and operations. The GOL is presently in the midst of a severe fiscal crisis which is not expected to abate for several years. In these circumstances the project proposes filling only 26 of the 36 new staff positions identified by the project design team. Hiring for these new positions will be phased so that only 16 are filled during the first five years. Nonetheless, CARI will probably have to make considerable cost savings in other aspects of CARI's operations to be able to fund even these new positions.

II. GOL Fiscal Position

As Table D-1 shows, the GOL has been running substantial budget deficits since the 1978/79 budget year. Expenditures on the 1979 OAU summit meeting account for some of the deficit that year. The deficit was further exacerbated in 1980/81 and 1981/82 by the government salary hikes and new hiring in the wake of the 1980 coup d'etat. In two years the recurrent budget grew over 60 percent, reaching a peak of $289 million in 1981/82. At the same time, GOL revenues remained stagnant because of falling export earnings and a decline in domestic business activity following the coup. By 1981/82, the GOL deficit had reached $117.7 million or 40 percent of the budget.

Because Liberia uses the U.S. dollar as its currency, the GOL cannot finance deficits through inflationary monetary expansion. Rather, deficits have created severe liquidity shortages as the government does not have sufficient funds to back the checks it issues. As a result, the GOL regularly delays the issuance of budget allotments -- sometimes for several months -- until there is enough cash available to make good its checks.

To combat its deteriorating fiscal position, the GOL has entered into three Standby Agreements with the IMF. AID has also provided substantial budget support through ESF program grants. As a condition to AID and IMF assistance, the GOL has instituted several economic reforms and fiscal measures including a hiring freeze since 1981/82 and a salary cut in January 1983 for all government employees ranging from 16.7 to 25 percent. Nonetheless, the deficit has yet to be reduced to a manageable level and even the $50 million estimated for the 1983/84 deficit may be optimistic.

A final resolution to the budget problem will require Liberia's economic recovery which, in part, will depend on renewed demand for Liberia's exports and a return of business confidence. In the

meantime, additional budget cuts will be necessary to control deficits. The Development Budget will undoubtedly absorb a large portion of these cuts. To a large extent the Development Budget has been treated as a residual, being given lower precedence than recurrent expenditures, especially salaries. Already the Development Budget has been reduced by a third from its high in 1979/80. Further, more severe cuts are expected in 1984/85 because of the continuing crisis.

III. CARI's Budget

CARI's budget is included in the Development Budget (though the nature of most of CARI's expenditures -- salaries and operating costs -- are in fact recurrent costs rather than development investments). To date CARI's budget allocations have been very favorable. CARI's recurrent budget (excluding construction and new equipment) rose 14 percent between 1981/82 and 1982/83 and an additional 6 percent between 1982/83 and 1983/84 though the Development budget itself over these two years fell over 12 percent. In part, this is due to the GOL's greater emphasis on agriculture. (The Ministry of Agriculture's share of the Development Budget has grown in absolute terms since 1979/80 despite the continual reduction in the Development Budget.) Also, CARI's budget has been wholly financed by counterpart generation from PL-480 Title I rice sales. CARI's 1983/84 budget was $2.25 million including $380,000 for construction.

Nonetheless, the GOL's fiscal crisis has had a major impact on CARI's operation. Quarterly budget allotments to CARI (as to virtually all GOL entities) have been running one to two quarters late. CARI's final quarterly allotment for 1983/84 will not only be delayed but most probably reduced by 50 percent. While CARI has been able to meet its payroll on time -- unlike many GOL ministries -- it has had to reduce or delay expenditures on supplies and materials. Yet, the availability of such items is vital in a research program where, because of the agricultural cycle, a short delay in procurement can set back an experiment an entire year. CARI's 1983/84 budget and actual expenditures are compared on Table D-2. As the table demonstrates, CARI's expenditures have been running about 15 percent below budgeted levels because of delays in receiving allotments.

Given the GOL's fiscal position and the severe cuts expected in the development budget, it is likely that CARI's budget will be frozen or reduced over the next four to five years.

IV. Financial Implications of Project

The project calls for 26 new positions to be filled over the course of ten years. The incremental cost of hiring a new professional staff member is calculated to be $25,000: $8,000 for salary and $17,000 for support costs. (See Table D-3 for method of calculation for these costs.) Thus, the additional annual recurrent burden to the GOL of the project will be $650,000 in 1984 dollars by the end of the project. In addition, CARI will need to construct some 20 staff houses and purchase some additional equipment for the new staff. The total incremental cost of the project can be found on Table D-4.

Table D-5 presents an estimate of GOL project expenditures based on CARI's present budget of $2.25 million which includes $1,645,000 for recurrent cost, $225,000 for equipment and $380,000 for construction. Based on these projections, CARI's total budget requirements (including Saye Dube) will exceed its present budget by GOL Budget Year 1985/86 even though CARI's annual construction requirements will be far below its present budget of $380,000. Given the prospect of major budget cuts over the next four-to-five years, it is unlikely that CARI will be able to expand its budget significantly or even retain its present levels.

Given these likely fiscal constraints, Table D-6 presents an alternative budget with a lower projected expenditure rate for CARI's present level of operations and staff. In calculating this reduced budget, it was assumed that actual expenditure rates for recurrent costs (not the budgeted amounts) for the first half of 1983/84 represent the minimum level of support needed by CARI's present staff and operations to be effective. As with Table D-5, it is assumed that CARI salaries remain frozen for the first five years of the project. Thus the annual recurrent cost of operating CARI at its present staffing level is $1.6 million in 1984/85, a little over $1.7 million by 1988/89, and under $2.1 million by 1993/94 (row 1.f of Table D-6). The costs of adding more staff and operating Saye Dube would be unchanged. The total cost of the project (line 4 of Table D-6) in year one would be $1.86 million, increasing to $2.2 million by year five and $3.3 million by year ten.

These reduced cost projections would keep CARI's budget requirements below its present $2.25 million level through 1988/89. Still, CARI's budget may be cut to even lower levels. If this is the case, CARI would have to take even more severe economizing measures to be able to meet its new staff hiring requirements. Such measures would entail transferring superflous staff from CARI's budget (e.g., CARI's marine fisheries boat crew which cost $26,000 a year), transferring pension rolls ($17,000 a year) from CARI's payroll to the GOL's national pension budget, pensioning staff who are old and unproductive and transferring personnel in unskilled job catagories which are over staffed.

Table D-1

GOL Expenditures and Revenue: 1979/80-1983/84
(in $ millions)

	1978/79	1979/80	1980/81	1981/82	1982/83	Revised 1983/84 1/
Expenditures						
Recurrent	152.9	179.7	232.8	289.0	252.6	235.7
Development	212.8	134.0	124.2	96.4	90.9	77.2
Other 2/	--	--	--	11.6	11.9	--
Total	365.7	313.7	357.0	397.0	355.4	312.9
Revenue	224.9	225.8	242.4	279.3	257.4	270.5
Balance	-140.8	-87.9	-114.6	-117.7	-103.7	-42.4

1/ 1983/84 data represents estimates based on budgets and revenue projections. All other data are actual expenditures and receipts.

2/ Includes non-budgeted expenditures and encumbrances.

Source: IMF

Table D-2

Comparison of CARI Budget and Expenditures for Budget Year 1983/84

Item	Budget	Expenditures 7/83-1/84	Expenditures at annual rate*	Expenditures Annualized as % of Budget
Salaries	1,062	523	897	84.4
Support Svcs & Materials	583	257	441	75.6
Equipment	225	196	196*	87.1
Construction	380	234	234*	61.5
TOTAL	$2,250	$1,210	$1,768	%78.6

* This column extrapolated an annual expenditure rate from CARI's actual expenditures for July 1983 through January 1984. However, expenditures for equipment and construction were assumed to be forward funded and were not annualized.

Table D-3

Calculation of Average Recurrent Support Cost

The following budget items are considered essential support costs:

Recurrent Support Cost Items

Item	(a) Budget	(b) Expenditures (7/83 - 1/84)	(c) Adjusted Annual Rate
Utilities	95,000	30,226	51,815
Vehicle Repair	30,000	10,789	18,495
Office Equipment	7,200	-	1,000*
Local Travel	15,000	2,480	4,250
Foreign Travel	27,000	15,582	26,710
General Materials	8,000	1,280	2,195
POL	225,000	146,477	250,100
Ag. Material	40,000	2,938	35,000*
Stationary	10,000	3,816	6,540
Scientific Materials	18,000	1,119	10,000*
Bldg. Main. Materials	55,288	31,578	54,135
TOTAL	$530,500	$247,285	$460,240

Note that column (a) represents CARI's revised 1983/84 budget, column (b) represents CARI's actual expenditures per line item July 1983 through January 1984 and column (c) is derived from annualizing the actual expenditure figures from column (b). Three items marked with an asterisk (*) have been adjusted upwards. In the case of agricultural and scientific materials, expenditures are usually seasonally higher during the end of the fiscal year and, thus, are not fully reflected in the July-January expenditures.

Also note that support costs include no labor since CARI's present surplus of labor is considered more than sufficient to meet the demands of the expanded program.

The average support cost for professional personnel are thus derived by dividing the total annualized real support expenditures, column (c), by the number of professional staff on board during this period which was 27.

$460,240/27 = $17,046

Table D-4

GOL Incremental Expenditures for Project by GOL Budget Year
(in $1000's)

Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
1. Personnel											
a. (Number of New Hires) (Cumulative)	(5)	(8)	(11)	(14)	(16)	(22)	(26)	(26)	(2[illegible])	(26)	
b. (Number on Station)	(5)	(6)	(6)	(8)	(9)	(16)	(15)	(16)	(22)	(24)	
c. (Number in Training)	(-)	(2)	(5)	(6)	(7)	(6)	(11)	(10)	(4)	(2)	
Salary Costs	40	56	68	88	100	152	164	168	192	200	1228
2. Support Costs											
d. (Number requiring Support)	(3)	(3)	(3)	(5)	(7)	(10)	(13)	(16)	(22)	(24)	
e. Cost	51	51	51	85	119	170	221	272	374	408	1802
3. f. Commodities						50	75	75	100	100	400

Table D-4 Continued.

	Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
4.	Construction											
	g. Number of Houses		(3)		(3)		(3)	(4)	(3)	(4)		
	h. Cost of Houses		150		150		150	200	150	200		1000
	i. Other Construction					50	50		50			150
5.	j. Total	91	257	119	323	269	572	660	715	866	708	4580
	k. Inflation	0	16	6	41	36	117	170	222	317	265	1190
6.	l. Grand Total	91	273	125	364	305	689	830	937	1183	973	5770

Table D-5

Projected Total COL Expenditures for Project by COL Budget Year
($1,000's)

Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
Existing CARI Operations											
a. Personnel	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	10,600
b. Support Costs	580	580	580	580	580	580	580	580	580	580	5,800
c. Equipment	230	230	230	230	230	230	230	230	230	230	2,300
d. Subtotal	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	18,700
e. Inflation	--	30	65	100	140	400	495	590	690	790	3,300
f. Total	1,870	1,900	1,935	1,970	2,010	2,270	2,365	2,460	2,560	2,660	22,000
Project Incremental Costs											
g. Personnel	40	56	68	88	100	152	164	168	192	200	1,228
h. Support	51	51	51	85	119	170	221	272	374	408	1,802
i. Equipment	--	--	--	--	--	50	75	75	100	100	400
j. Construction	--	150	--	150	50	200	200	200	200	--	1,150
		257	[illegible]	323	269	572	660	715	866	708	4,580

.....continued

Table D-5 continued

Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
l. Inflation	--	10	4	29	29	97	145	193	281	258	1,046
m. Total	91	267	123	352	298	669	805	908	1,147	966	5,626
3. Saye Dube											
n. Outstations	167	167	167	167	167	167	167	167	167	167	1,670
o. Inflation	—	7	14	21	28	36	44	53	61	71	335
p. Total	167	174	181	188	195	203	211	220	228	238	2,005
4. Grand Total	2,128	2,341	2,239	2,510	2,503	3,142	3,381	3,[illegible]8	3,935	3,864	29,631

Table D-6

Projected Total GOL Expenditures for Project Based on Reduced Budget Levels
(in $1000's)

Budget Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	Total
1. Existing CART Operations											
a. Personnel	900	900	900	900	900	900	900	900	900	900	9,000
b. Support Costs	500	500	500	500	500	500	500	500	500	500	5,000
c. Equipment	200	200	200	200	200	200	200	200	200	200	2,000
d. Subtotal	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	16,000
e. Inflation	--	28	57	88	114	187	259	333	411	492	1,969
f. Subtotal	1,600	1,628	1,657	1,688	1,714	1,787	1,859	1,933	2,011	2,092	17,969
2. Project Incremental Costs	91	267	123	352	298	669	805	908	1,147	966	5,626
3. Save Dube	167	174	181	188	195	203	211	220	228	238	2,005
4. Total	1,358	2,069	1,961	2,228	2,207	2,659	2,875	3,061	3,386	3,296	25,600

ECONOMIC ANALYSIS

Rice is the most important crop in Liberia. It is produced by over 87 percent of all agricultural households. It is produced primarily for home consumption with increasing amounts being sold off the farm to meet urban needs.

Cassava is the second most important product grown by subsistence farmers and occupies a significant role in the bush-fallow system of production and in consumption in the rural areas.

With growing urban population, Liberia has found it necessary to import increasing quantities of rice. Most of this has come from the U.S. with a high proportion of those imports under the P.L. 480 program. In 1983 Liberia imported 85,500 metric tons of rice of which 45,000 tons were provided by the P.L. 480 program.[1/]

Increased domestic production of rice is limited by high labor requirements and low yields, not by unavailability of land. About 90% of the rice produced is upland rice which is produced under the bush-fallow system. The other 10 percent is produced in lowlands under the flooding system. Using traditional upland varieties and methods of cultivation, about 1700 hours are required to produce a ton of rice in Liberia compared to about 4 tons of rice produced with the same amount of labor in Thailand.

The larger amount of labor required for upland rice production results in low labor productivity and limits the rice production per household to about 3.7 acres. With rice production using such a high proportion of available labor and with labor productivity being so low, farm incomes are low relative to nonfarm incomes. This gap will widen over time unless ways can be found for increasing labor productivity on farms.

The approach which CARI has used in trying to increase labor productivity in rice production has been to (1) try to increase upland rice yields under current production practices, (2) promote expansion of swamp rice production which has a higher yield than upland rice, (3) develop alternatives to the bush-fallow system of production for upland rice and (4) initiate research on means to utilize animal traction.

CARI has identified higher yielding varieties of rice for upland production. LAC-23 produces about 25 percent more rice than traditional varieties and has been adopted by some participating farmers in the county agricultural development projects. However, farmers have been reluctant to plant LAC-23 preferring to continue with a part of the acreage planted to the traditional varieties. The new technology package requires use of

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1/ Liberia Produce Marketing Corporation data

commercial fertilizer which farmers apply the first year. Experience in Lofa and Bong counties shows farmers are unable to maintain the increased yield in succeeding years. It is not clear why yields decline. It may be due to reduced levels of fertilizers being applied or to flaws in the production package.

Although swamp rice yields significantly more than upland rice (2,645 kg/ha in Bong and Lofa counties in 1978-80 compared to 1,202 hg/ha for upland rice) the area in swamp rice production has expanded less than researchers and policy makers had hoped. Part of this appears to be due to undesirable working conditions in swamp rice production and the fact swamp rice production is considered women's work. In traditional upland rice production, women do the seeding, scratching in and weeding while men do the land preparation function. The switch to swamp rice places a burden on women which they may not be physically capable of or be willing to accept. As with improved upland rice varieties, the yield for swamp rice varieties tends to decline with time under traditional technology.

At CARI only a very limited beginning has been made on alternatives to the bush-fallow system of production. However, some promising results were obtained in the first year that two alternative systems were observed. No work has yet been undertaken to learn how forage crops grown in the rotation might be utilized by livestock or how rotation crops might be used for human food.

It has been observed that given the present cost and price structure for rice production, producers tend to cut back acreages devoted to rice when they are able to obtain high yields. This releases labor for production of other higher paying tree crops especially coffee, cocoa and palm oil. Work done by Jenne shows returns per hour of labor of $1.58 per hour of labor in upland rice, $1.94 per hour for swamp rice, $9.50 for coffee production, $14.31 per hour for cocoa production and $7.50 per acre for palm oil production.[2/]

At first glance the observed tendency to cut back acreage for rice production when higher yields are obtained may appear irrational and disappointing to policy makers. However, it may be the logical economic alternative until other means are found for increasing labor productivity in rice production. This puts increased emphasis on the need for more intensive research on swamp rice production alternatives to the traditional bush-fallow system and more research toward oxen mechanization.

Since Liberia is a participant in the International Coffee Agreement and currently fills its quota, growth in demand is likely to be

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2/ Assumes rice price of $.15/lb., cocoa $.65/lb., coffee $.65/lb. and palm oil $3.00/gallon. All crops are assumed to be grown under traditional conditions. Theodore Jenne, "Agriculture in Liberia: Realities, Problems and Potentials." Diskussionpapier NR. 12, February, 1982, p. 12.

small unless coffee is sold outside the agreement at lower prices. Because Liberia's cocoa makes up such a small part of world cocoa production it can probably significantly increase its production with very little effect on world cocoa prices. However, cocoa prices tend to fluctuate dramatically from year to year and do not provide a dependable source of export earnings.

Of the three tree crops, palm oil, appears to have the greatest economic potential. Palm oil seems to hold the most promise because of good growing conditions in Liberia and expanding world demand for palm oil as contrasted to stagnating demand for coffee and slowly growing demand for cocoa. Palm oil production has two other advantages. It could provide the raw material for further processing in Liberia e.g. soap production and margarine. Increased production of palm oil meal would provide a source of protein meal for increased livestock production.

Economic analysis of institution building projects is problematical, and that for a research institution is doubly so because of the difficulties in projecting and quantifying the benefits of technological change. The purpose of this analysis is not to precisely predict CARI's economic return but to demonstrate that the project will produce a positive return given a plausible assumption about what CARI's impact on agricultural productivity should be.

The benefits of the project are taken to be the increase in agricultural production that CARI's research will induce with this project compared to a baseline case for agricultural production in which CARI's institutional capabilities are not enhanced beyond their present levels. In this baseline case (column b, table E-1), it is assumed that traditional agricultural production, estimated at $165 million per annum, will grow at 2 percent per annum in real terms. Most of this growth is accounted for by growth in the agricultural population (approximately 1.7 percent per annum). A small portion of this increase is the result of technological innovations including those that CARI would develop even without a Phase II project. With the Phase II project, it is assumed that the real growth rate will increase to 2.5 percent per annum by year ten of the project when the impact of the project (i.e. better extension liaison, better technological packages, etc.) begins to take effect (column a). Thus the net benefit of the project is an increase in the net value of output in the traditional sector of 0.5 percent per year. This increase represents an overly conservative estimate of the project's impact on agricultural productivity. However, the purpose of this analysis is not to predict the project's benefit but to demonstrate that the project remains justifiable given such conservative estimates. The analysis is carried for 20 years beyond the life of the project. While benefits will accrue beyond that point, they will be insignificant in value because of discounting. Net increase in output here in the economic sense is the free market value of the additional output of commodities (i.e. rice, roots and tubers, legumes and pulses, animal products) less additional costs incurred both privately and socially to increase the output.

The cost of the project includes not only the costs of direct inputs during the life of project by AID and the GOL, but also the higher recurrent costs

of operating CARI after the project ends (column d). In the baseline case (i.e., if the project is not undertaken) it is assumed that CARI's present recurrent budget remains unchanged (column e).

From these data, a projected stream of benefits and costs have been calculated (columns g and h) at a discount rate of 10%. At this rate, the net present value of benefits is $29.6 million and the net present value of costs are $18.8 million. The benefit cost ratio is 1.6 and the net present value of the project is $10.8 million. Thus, even if the project has only a marginal effect on agricultural productivity among small farmers, the project remains economically justifiable.

TABLE E-1: PROJECT BENEFITS AND COSTS (in $1000s)

	BENEFITS			COSTS			DISCOUNTED VALUES @ 10% Rate		
	Traditional Agriculture Output								
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Year	With Project	Without Project	Incremental Benefits	With Project	Without Project	Incremental Cost Of Project	Discounted Benefits	Discounted Costs	Net Present Value
1	165,000.0	165,000.0	0.0	4,588.0	1,870.0	2,718.0	0.0	2,718.0	(2,718.0)
2	168,300.0	168,300.0	0.0	4,639.0	1,870.0	2,769.0	0.0	2,517.0	(2,517.0)
3	171,666.0	171,666.0	0.0	4,426.0	1,870.0	2,556.0	0.0	2,112.4	(2,112.4)
4	175,099.3	175,099.3	0.0	4,395.0	1,870.0	2,525.0	0.0	1,897.1	(1,897.1)
5	178,601.3	178,601.3	0.0	3,896.0	1,870.0	2,026.0	0.0	1,383.8	(1,383.8)
6	182,173.3	182,173.3	0.0	3,994.0	1,870.0	2,124.0	0.0	1,318.8	(1,318.8)
7	185,816.8	185,816.8	0.0	4,387.0	1,870.0	2,517.0	0.0	1,420.8	(1,420.8)
8	189,533.1	189,533.1	0.0	4,717.0	1,870.0	2,847.0	0.0	1,461.0	(1,461.0)
9	193,323.8	193,323.8	0.0	3,178.0	1,870.0	1,308.0	0.0	610.2	(610.2)
10	197,190.3	197,190.3	0.0	2,885.0	1,870.0	1,015.0	0.0	430.5	(430.5)
11	201,134.1	201,134.1	0.0	2,687.0	1,870.0	817.0	0.0	315.0	(315.0)
12	206,162.4	205,156.8	1,005.7	2,687.0	1,870.0	817.0	551.5	236.4	65.1
13	211,316.5	209,259.9	2,056.6	2,687.0	1,870.0	817.0	655.3	260.3	395.0
14	216,599.4	213,445.1	3,154.3	2,687.0	1,870.0	817.0	713.7	236.7	477.0
15	222,014.4	217,714.0	4,300.4	2,687.0	1,870.0	817.0	1,132.4	215.1	917.3
16	227,564.7	222,068.3	5,496.5	2,687.0	1,870.0	817.0	1,315.8	195.6	1,120.2
17	233,253.9	226,509.6	6,744.2	2,687.0	1,870.0	817.0	1,467.7	177.8	1,289.9
18	239,085.2	231,039.8	8,045.4	2,687.0	1,870.0	817.0	1,591.7	161.6	1,430.1
19	245,062.3	235,660.6	9,401.7	2,687.0	1,870.0	817.0	1,691.0	146.9	1,544.0
20	251,188.9	240,373.8	10,815.1	2,687.0	1,870.0	817.0	1,768.3	133.6	1,634.8
21	257,468.6	245,181.3	12,287.3	2,687.0	1,870.0	817.0	1,826.4	121.4	1,705.0
22	263,905.3	250,084.9	13,820.4	2,687.0	1,870.0	817.0	1,867.6	110.4	1,757.2
23	270,503.0	255,086.6	15,416.3	2,687.0	1,870.0	817.0	1,893.8	100.4	1,793.5
24	277,265.5	260,188.4	17,077.2	2,687.0	1,870.0	817.0	1,907.1	91.2	1,815.9
25	284,197.2	265,392.1	18,805.0	2,687.0	1,870.0	817.0	1,906.2	82.9	1,826.2
26	291,302.1	270,700.0	20,602.1	2,687.0	1,870.0	817.0	1,903.5	75.4	1,828.1
27	298,584.7	276,114.0	22,470.7	2,687.0	1,870.0	817.0	1,898.4	68.6	1,815.9
28	306,049.3	281,636.3	24,413.0	2,687.0	1,870.0	817.0	1,892.2	62.3	1,799.8
29	313,700.5	287,269.0	26,431.5	2,687.0	1,870.0	817.0	1,872.9	56.7	1,776.2
30	321,543.0	293,014.4	28,528.6	2,687.0	1,870.0	817.0	1,854.4	51.5	1,746.9
Total	6,944,605.2	6,693,733.1	250,872.1	94,845.0	56,100.0	38,745.0	29,2[illegible]3.0	18,519.6	10,753.4

Best Available Document

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SOCIAL SOUNDNESS ANALYSIS

I. Target Group

CARI's principal mandate is to develop technologies that will raise the income and production of Liberian small holders. This group is comprised of 70 percent of Liberia's work force, in some 150,000 farm households. They account for about 18 percent of Liberia's GDP.

These farmers are generally characterized as semi-subsistence. Virtually all grow upland rice for household consumption using a slash and burn system. Most grow roots, tubers and vegetables as well, again for household consumption though surpluses may be sold in local markets. Some swamp rice is also grown, though usually for sale or as insurance against the "hungry time" just preceding the upland rice harvest. Coffee, cocoa or other crops are often grown for cash. However, cash crops almost invariably are given less precedence than food crops that meet the household's subsistence needs. Farmers may also raise goats, sheep or other livestock as a means of storing wealth to be slaughtered on a special occasion or sold when cash is needed. Recently fish ponds have been introduced as a cash-generating farm enterprise.

On most farms, there is a distinct division of labor between the sexes. In almost all cases, men are responsible for cutting the bush and burning the debris to clear fields. Planting rice and weeding are usually performed by women as is harvesting, though men may assist in this last task. Many crops are associated with one sex. Coffee and cocoa are grown by men in most cases while swamp rice is more often the responsibility of women.

Households are not necessarily unitary entities. Upland rice is usually cultivated by the household as a whole and the harvest allotted to household members. Coffee or cocoa, in contrast, may be tended solely by a male member of the household who receives all of its cash income. Likewise, female members of the household may grow swamp rice for sale and not be obliged to share the income with other household members. In some cases, an individual living with a household may have only a weak claim in sharing in its rice harvest. In this case he or she might farm an individual plot as well to supplement income or diet.

As a rule all land in Liberia to which no tribe has laid claim through the possession of a deed is considered public land, the law automatically gives guarantee of right of occupancy to ethnic groupings. Each ethnic grouping is entitled to the use of as much public land in that particular area, as long as the land will be used for farming purposes. In such cases the right of possession of that land goes to that ethnic grouping as against any person whomsoever.

Before a farmer who is not a member of that ethnic grouping can farm on any portion of the tribal lands, he is required to get the permission of the tribal authorities and must pay rent either in kind or in cash for such lands. A member of the same ethnic grouping will be required as part of the custom to either share crop after harvest or pay a token which may not be considered as rent but just a gesture of goodwill to the tribal authority. If he wants to own the land he has to go through the normal process of owning the land. A farmer does not establish right to land just by farming on it, particularly in the case of the subsistance farmer.

While Liberian small holders generally share these characteristics, there are numerous variations and exceptions among them. There are some 16 different ethnic groups in Liberia. Among each there are differences as to division of labor between sexes, which crops are grown and by which sex, preferences for food, land rights, etc. There are some major differences in cultural practices. In the Southeast, for example, rice is planted by placing seeds individually in a drilled hole while in almost all other places rice is broadcasted. Also, some southeastern communities cultivate community plots laid out by the village elders while most other groups leave it to household heads to pick which area to cultivate.

Finally, farmers have different degrees of access to markets, information, etc. In the central and northern counties, access to roads, markets, and inputs is relatively good, especially in the target area of the three area development projects in Bong, Lofa and Nimba Counties which also provide effective extension services. In other areas the farmer may have virtually no access to markets and little opportunity to sell produce. A few areas, notably upper Lofa County, have access to hired labor while most areas do not.

II. Social Feasibility of Adaptive Research

As has been emphasized in the technical analysis, social feasibility must be integrated along with technical and economic feasibility in assessing research priorities and the viability of proposed technological changes. The incompatibility of a technology with customary divisions of labor or the land tenure system can be as great an impediment to its adoption as its failure to raise production or generate a financial return.

Consideration of social and customary factors should be thoroughly examined at two points in the adaptive research process. First, it should be used throughout the planning stage when the long range strategy for research is set, when individual departments develop their research programs and when specific research proposals are reviewed and approved. (See Section IV C., "Research Administration" of Annex B for details of the research planning process.) At each step consideration must be given to the likely social feasibility of the technology being investigated.

A second point when social factors need to be integrated into the research process is when a technology developed on station is tried on farmers' fields to evaluate its feasibility in "real-world" conditions. These trials, supervised by the Farming Systems Research Committee, are intended to verify not only the technology's physical performance in terms of yields, etc., but also examine its financial return, impact on other elements of the farming system and compatability with norms and custom. (See Section IV D. of the Technical Analysis on Off-Station Testing.)

Given the diversity and complexity of Liberian farming systems, careful and extensive study of Liberian farmers will be needed to identify and analyze the social factors that will impinge on the viability of proposed technological innovations. This will be the responsibility of CARI's Socio-Economics Department which will conduct systematic survey work supervised by an agricultural economist and rural sociologist. The selection of farmers for sampling must encompass not only agro-climatic but social criteria as well to cover different ethnic groups and different segments of each culture, especially the different members of a household, not just household heads. The survey is one of the principle means by which the Liberian farmer can participate in the research process. Farmers will thus have the opportunity of identifying themselves what they perceive as their greatest needs. Likewise, through on-farm trials farmers will have the opportunity to directly judge the acceptability of a new technology.

While social factors and constraints must be continually studied and reassessed by the Socio-Economic Department, some generalizations can be made now about the most important of these. First is the primacy of subsistence crops, notably rice, in the small holder system. While studies have shown that the financial returns to labor for tree crops and other cash crops are several times higher, almost all farmers see meeting the food needs of the household rather than maximizing income, as their principal goal. Thus, while nearly all Liberian farmers have some cash income, cash crops are usually treated as a residual item in which surplus time can be invested. Only in a few areas have cash crops been adapted on a scale where they affect subsistence agriculture - as in upper Lofa County where some heads of households have reduced the time devoted to rice so as to work on cocoa and coffee.

A second factor is the general conservatism of subsistence farmers. This conservatism has a rational economic basis: given the small margin of surplus above the household's bare subsistence needs, small holders are very adverse to taking risks. Thus, the technologies that are most readily acceptable are those with little risk and little disruption to traditional practices. Improved seed varieties are the most readily adopted while a system of continuous cropping will be accepted only slowly. Probably the best strategy for transforming small holders into commercial producers would be a farming system which integrates high value cash crops with subsistence rice.

III. Spread Effect

The spread effect of CARI's adaptive research will be determined by several factors, most of which cannot be controlled by CARI itself. It is important that CARI's socio-economic surveys and farming systems research encompass a variety of different farming systems in representational agro-climatic zones and different ethnic groups. Only by incorporating a large range of farming systems in their research can the socio-economic and FSR units insure that the technologies that CARI develops will be compatible to the social, economic and technical contexts of a broad segment of Liberian farmers.

However, the principal vehicle for delivering CARI's technologies to the farmer will be extension services. Presently there are two kinds of extension operations. One is provided by the ADPs in Nimba, Bong and Lofa Counties. These services are generally well supplied, supervised and motivated (though expensive). The rest of the country, however, must rely on the Ministry of Agriculture's extension service which is largely under-funded, unmotivated and ineffective. If farmers outside of the three ADP areas are to benefit from CARI's research, new means of extension must be devised. Setting up new extension services is beyond CARI's mandate.

Another factor that will affect the spread of new technologies will be access to markets. The main thrust of technological innovation will be commercialization. Given that most households are fairly self sufficient, the major incentive for adopting new technologies would be to produce a surplus for market. Thus, a farmer with ready access to markets will have a greater incentive for adoption.

IV. Project Impact

The project will have a beneficial impact on several levels of Liberian society. The most direct will be to the farmer. New technologies will allow him or her to earn more income through production of cash crops and surplus food. Higher productivity will also allow the farmer to divert his/her labor and resources to alternative uses. Women should be able to benefit from agricultural innovations as well as men (though not necessarily from the same innovations as is discussed below).

Greater productivity will be reflected in many cases in lower food prices. This will benefit urban Liberians, especially the poor who spend a larger share of their income on food. Also, the national economy and the public as a whole will benefit by an increase in agricultural exports and the expansion of the rural economy.

There will be substantial differences in the distribution of these benefits, however, especially among farmers. As was explained above, the spread of new technologies will be greatly determined by the operation of

extension services and markets -- factors that the project cannot control. Thus, the better developed counties will benefit more than the more remote counties that lack roads and extension services.

Another differential impact will result from the division of labor between the sexes. A technology which reduces weeding would benefit women since thay are largely responsible for this task. Conversely, a technology which requires more weeding would add work for women. At this point it is impossible to predict what technologies will be developed and what impacts they will have. However, as men usually cultivate coffee, cocoa and other cash crops, they seem most likely to benefit from the trend toward commercialization. However, innovations in food crops will allow greater surplus production which women sell for cash. Also, some women who head households and have considerable resources have been able to establish coffee and cocoa farms. Access to hired labor may be required, however, which would limit such systems to certain border areas where migrants provide seasonal casual labor.

The shift to greater commercialism may have other effects on the structure of traditional societies. Greater commercialization will mean that a greater portion of household incomes will be received as cash by individuals rather than distributed among the household as food. Greater commercialization may affect nutrition also. However, a study of nutrition in Liberia found little severe malnutrition and no lack of food. Almost all nutritional problems could be traced to bad practices and lack of information rather than availability of foods.

Finally, the move to a more continuous cropping system and permanent fields will put pressure on the present land tenure system. In the past, Liberia's dual tenure system which allowed freehold rights to be established was abused by the non-indigenous elite, often by coopting traditional authorities, to secure rights to large tracts for rubber plantations and other uses. The innovations promoted by CARI should not favor large commercial operations that will create a demand by non-indigenous peoples to secure land for large-scale farming. However, some traditional authorities will have to adapt traditional rights to accomodate greater security for land improvements.

ENGINEERING ANALYSIS

CARI's infrastructure has been significantly expanded during Phase I including the construction of three laboratories (for the Crop Science, Animal Science and Soils and Water Department) funded by the GOL and six staff houses funded by AID for the technical assistance team. During the remaining portion of Phase I AID will also fund rehabilitation work on CARI's water and electrical systems.

AID Construction

Several more construction activities will be funded under Phase II. Construction funded by AID will include:

1) Staff Housing: AID will fund the construction of an additional four staff houses next to the technical assistance team's housing. USAID/Liberia has retained the construction drawings for the technical assistance team's housing, and these drawings will be utilized for the new housing. Therefore, the exact size and type of housing is already known, and costs can be accurately estimated. This additional housing will be constructed in the first year of the Phase II project and will be allocated to CARI senior staff and the contractor's administrative assistant. As the technical assistance team is phased out over the last years of Phase II, additional housing will be available for CARI department heads. Housing construction of this design which is basic and simple, but comfortable, costs approximately $45 per square foot.

2) Fertilizer and Chemical Storage: A building for storing fertilizers and chemicals will be constructed with AID funds during the first year of Phase II. This building will be environmentally controlled because Liberia's hot and humid climate causes rapid deterioration of fertilizers and many chemicals. A building of 600 square feet is required to store approximately 6,000 bags of fertilizer and provide a 10' X 20' space for tables and chemical storage. The type of building materials required are known; the building will have a concrete floor, masonry block walls and an insulated ceiling. Presently, construction costs for this type building in Suakoko are $40 per square foot.

3) Agricultural Engineering Building: This will be a major structure to house the combined post harvest technology and agricultural mechanization units. It is presently known what this building will house and, consequently, the size of the building can be estimated fairly accurately. This building will house a cassava peeler, cassava grader, cassava press, a press for oil and palm kernels, plus dryers and grinders for coffee, cocoa, maize, peanuts, etc. 1,500 square feet has been calcualated as the space required to house this equipment and operating space.

In addition, this building will house wood and metal working shops. Individual pieces of wood may reach 10 - 12 ft. in length, and sawing and millwork may be performed simultaneously. Metal work may involve the same lengths of materials, while requiring arc welding, brazing, or acetylene welding. The metal works must be separated from the woodworks to prevent fire. A floor area of 3,000 square feet has been calculated as sufficient to accomplish woodworks and metal works safely.

There will be four small administrative offices in the building measuring about 10' X 12.5' totaling 500 square feet, bringing the total square footage of the agricultural building to 5,000 square feet. The type of building construction is presently known. It will be of typical Liberian construction, i.e., concrete footings, masonry block walls, corrugated metal roofing with masonry plastering and paint finish. Current prices for typical building construction is $40 per square foot. Construction will be undertaken during the second year when the long-term agricultural engineering advisor will be present to assist in designing and equipping the building.

4) Plant Protection Building: The plant protection building will be a self-contained facility comprised of a potting room requiring approximately 2,000 square feet for potting and storing plants plus storage of manure, fertilizer, tools and pots; a storage room of 1,000 square feet for storing pesticides and sprayers; laboratory space of 1,500 square feet, plus four administrative officals totaling 500 square feet. The size of these rooms has been determined, in large, by agronomists familiar with the precise nature of their needs. The type of building construction is known.

This building will be of typical Liberian construction consisting of concrete footings, masonry block walls, corrugated metal roofing with masonry plastering and paint finish. Current prices for this type construction is $40.00 per square foot.

5) Fish Research Ponds: Ten acres of CARI land will be added to the fish research ponds at a new site downstream from the existing CARI fish research ponds. This area will permit the addition of 40 new research ponds with better water and fish propagation control. The size of the ponds is known from existing ponds; therefore, the number of new ponds that can be constructed in the ten acre site can be calculated rather accurately. Construction will involve the following:

Earthwork, 10,000 yd.^{3} @ $3.00/yd^3 =	$30,000
Concrete Water Control Structures	8,000
Seeding	2,000
Total	$40,000

6) Machine Shed: The size of this shed can be estimated fairly accurately because of the known equipment that it will be used to protect. A 20' x 40' structure is needed to shelter six tractors, a disc, mower attachment, sprayer attachment and other implements, in addition to several pickups. The building will be of simple post and beam constructon which, at present, costs about $20 per square foot.

7) Fencing for Research Plots: A major problem in collecting research data is pilferage of produce from research plots. Fencing can be used to discourage this for high value crops in orchards and more-or-less permanent fields. It has been estimated that two miles of fencing is required.

8) Library Expansion: The present library requires at least an additional space for more bookshelves and reading area. This can be added on to the existing library room. Taking into consideration the size of the existing library and the number of additional bookshelves needed, it has been estimated that an additional 500 square feet is needed.

9) Tissue Culture Facility: This is an addition to the plant propagation building now under construction under Phase I.

10) A final construction element will be an expansion of CARI's electrical system. This will entail increasing CARI's generating capacity, and expanding and extending the transmission and distribution system. Preliminary plans have been prepared under the Phase I project, estimating costs at $200,000. These plans will be reviewed and modified as needed prior to construction in year four.

Method for Design and Construction.

AID will contract directly for all construction. In most cases AID will also contract with an architectural engineering consulting firm to provide engineering supervision of the construction contractor. However, for the fencing, the machine shed and fish ponds, the construction is small and simple enough for CARI's staff to supervise the construction contractor. USAID's resident engineer willl periodically inspect construction as part of the routine AID monitoring function.

The plans and detailed drawings for the existing technical assistance staff housing will be used in constructing the additional four units under Phase II. While plans or detailed drawings are needed for the plant protection and agricultural engineering laboratories and chemical storage facility as well as for the library and tissue culture expansion, it is believed that the square footage needed in each instance is already known fairly well. In addition, costs per

square foot can be estimated to a relatively high degree of certainty because types of construction materials to be used/approved by USAID are known at this time. Likewise, plans for upgrading the electrical system exist but must be modified. AID will contract with architectural/ engineering consulting firms to do the necessary designs and plans. Plans for the fish ponds and machine shed will be the responsibility of the Title XII contractor which may require TDY assistance to prepare these.

Cost Estimates

The following table presents cost estimates for the various construction activities. Estimates are based on those supplied by local construction firms and on the cost of recent construction work at Suakoko.

AID Construction Cost Plan

Structure	Size	Unit Cost	Constr. Cost	Design/Supv Cost
Staff Housing	4 x 1600 ft^2	$45/$ft^2$	$288,000	$30,000*
Fert. & Chem. Stor.Facility	600 ft^2	$40/$ft^2$	24,000	3,600**
Fish Research Ponds	10 acres		40,000	
Machine Shed	800 ft^2	$20/$ft^2$	16,000	
Fencing	2 miles		10,000	
Ag. Eng. Bldg.	5000 $ft.^2$	$40/$ft^2$	200,000	30,000**
Library Ext.	500 ft^2	$45/$ft^2$	22,500	3,400**
Tissue Culture Facility	50 ft^2	$40/$ft^2$	30,000	4,500**
Plant Protection Building	5000 ft^2	$40/$ft^2$	200,000	30,000**
Expansion of Elec. System			200,000	20,000***
	Total cost		$1,030,500	121,500

* Supervision cost estimated at 10% of construction c
** Design and supervision cost estimated at 15% of co ction cost
*** Design cost estimated at 10% of construction cost

PROCUREMENT PLAN

A. Commodity Procurement:

Procurement of commodities will be performed using the following methods:

USAID, at the request of the Central Agricultural Research Institute, will make arrangements for procurement with a procurement services agent (PSA) in accordance with procedures set out in AID Handbook 15, Chapter 4. It is expected that the PSA will be contracted to procure all project commodities with the exception of vehicles, mini computers, library books (to be procured under American Overseas Book Company contract) and local cost procurement items. In addition, consideration will be given to procurement of audio-visual and darkroom equipment through the U.S. General Services Administration.

PSA fees are estimated to be under $100,000. Therefore, contracting for PSA services will be undertaken through informal solicitation of several sources. Payment procedures will be by bank letter of commitment, issued by AID/W, for the commodities and AID direct letter of commitment, issued by the USAID/Controller, for the PSA fees. The PSA will earn partial payments based on a schedule of 40 percent of the fixed amount per PIO/C as orders or contracts for commodities are placed, 50 percent of the fixed amount per category as the commodities are shipped to Liberia and 10 percent when the PSA has satisfactorily completed all work and all commodities have arrived at destination.

Those commodities not procured under the PSA contract will be procured by USAID directly or through the use of another U.S. government agency, i.e. GSA. In those instances where another U.S. government agency is utilized a worksheet PIO/C will be submitted to AID/W, M/SER/COM/CPS requesting procurement through a particular U.S. government agency.

USAID/Monrovia will procure locally available items. The project will use approximately $900,000 for local cost procurement of such items as office and farm supplies and tools, spare parts, petroleum oil and lubricants as well as local services.

B. List of Required Commodities

Following is the list of categories of equipment which will be procured as part of this project. Detailed lists of commodities to be procured under each category have been prepared by the Phase I contractor, CARI staff and the design team.. The commodity lists are detailed and consist of a large number of individual line items. These commodity lists will be refined and organized as required by the Phase II Title XII contractor in consultation with the Director of CARI so that procurement can be initiated as soon as possible following the signing of the project agreement and

meeting of the conditions precedent by the GOL. Additional commodity lists will be developed as required. Specifications will be developed by the host government and USAID for items where they have the experience and technical expertise. However, specifications for the majority of commodities to be procured will be developed by the Technical Assistance Contractor. The Project Manager may also request the services of the Regional Supply Management Officer, REDSO/WCA, to provide assistance in implementation of the procurement process.

D. Source of Procurement and Commodity Eligibility

The source and origin for commodities eligible for AID financing under this project is Geographic Code 000 (U.S. only). Vehicles must be procured from the United States unless a source/origin waiver has been obtained. A review of the commodities to be procured indicates that all should be available from the designated source/origin for the project except for motorbikes. Therefore a source/origin waiver request for the motorbikes is included in the project authorization (waiver justification is found in Annex Q).

E. Delivery Schedule

Timely delivery of commodities procured under this project will have a significant impact on the implementation of the project. Therefore, an implementation schedule will be prepared as early as possible. However, due to the quantity of items being procured and the ten year life of project, detailed implementation planning is difficult at this time. Initial planning, already underway, will involve establishing the commodities required during each year of the project. In order to maintain control it will be necessary for planning purposes to break the procurement process down into the component parts, beginning with the solicitation of bids and ending with the commodity arrival, inspection and acceptance at the project site. To determine dates by which each procurement must begin, backward planning will be utilized beginning with the date the commodities are needed at the site and allowing sufficient time for completion of each step in the procurement process for each transaction. The delivery schedule will be part of the operational planning, beginning at the time of the project agreement and continuing throughout the project.

The delivery schedule will take into account the desirability of consolidating purchases for shipment. Through the use of a detailed delivery schedule it is expected that the necessity for storing and warehousing commodities can be minimized. However, when necessary, provisions will be made for storage facilities which can be used to protect commodities against pilferage and deterioration by the effects of the weather.

F. Transportation

Commodities financed under this project will be shipped on vessels under the flag registry of the United States. In the event authorized flag vessels are not available, the supplier will be required to obtain a waiver

for nonavailability from AID/W, M/SER/COM/TR. An approved waiver for nonavailability must be obtained prior to shipment of the commodities.

All commodities will be procured on a CIF basis. For those commodities procured by the PSA, the PSA will be responsible for consolidating shipments to the extent possible, packaging for export when necessary, and arranging freight.

The GOL is responsible for clearing commodities through customs and arranging for transportation from the port of entry to the project site.

ANNEX I

PROJECT IMPLEMENTATION SCHEDULE

Years 1-5

DATE	ACTION	RESPONSIBILITY
August '84	Sign Grant Agreement	GOL; USAID
	Issue PIO/T	USAID (ARD)
Sept. '84	Issue RFTP	REDSO/RCD
Nov '84	Solicit PSA's for commodity procurement contract	USAID (ARD)
Dec '84	Select top technical proposal	USAID; REDSO; GOL
Feb.'84	Sign TA Contract	USAID; REDSO; RCO
"	Meet initial conditions precedent	MOA;CARI
March '85	Sign contract with PSA for commodity procurement	CARI; PSA
	Issue first PIO/C for project commodities - replacement vehicles and furniture for TA team	USAID (ARD)
April '85	Six long-term participants identified and applications forwarded	CARI: TA Contractor
May '84	TA team arrives	TA Contractor
"	CARI hires 5 new professional staff	CARI
June '85	Contract let for 4 CARI staff houses	USAID (EO & Engineer)
July '85	TA contractor submits annual workplan for USAID review (for 6 months)	Contractor
June '85	CARI submits research strategy to technical committee for approval	CARI; TA Contractor

"	CARI 83-84 annual research report published	CARI; contractor
June '85	Detailed plans and cost estimates developed for storage building and machine shed	USAID (Engineer) TA Contractor
"	Technical Committee reviews CARI research program for consistency with approved research strategy	Technical Committee
July '85	Issue second PIO/C for project commodities -scientific and farm equipment and supplies	USAID (ARD); TA Contractor
Aug '85	Send 6 long-term participants to US (Entomology, Rural Sociology, maintenance, Agronomy, tree crops, Animal Nutrition)	TA Contractor USAID (DP)
"	Advertise for construction contract for buildings, storage and machine shed	USAID; CARI
"	Draw up detailed plans for fisheries research ponds and facilities and advertise for construction contract	TA Contractor USAID
"	Ten MOA subject matter specialists nominated and assigned to CARI	MOA
"	Replacement vehicles and furniture arrive for TA team	USAID
Sept '85	Plan dry season research projects and resource requirements	TA Contractor CARI
"	Initiate socio-economic studies in Bong, Mamba and Lofa Counties	TA Contractor CARI
"	Detailed plan for research areas to be fenced, developed and PIO/C for fencing material issued	TA Contractor CARI; USAID (ARD)
Oct '85	Contractor selected for construction of storage building, machine shed	USAID
"	Four CARI staff houses completed	Construction Contractors

Dec '85	Agricultural Research Strategy adopted	GOL/Ag. Res. Council Tech Committee
Dec '85	Wet season research plots harvested and data analyzed	CARI; TA Contractor
Jan '86	Dry season research plots planned	CARI; Contractor
"	Five long-term participants selected and applications sent to appropriate universities	TA Team, CARI
"	Agronomist/breeder joins TA team	TA Contractor
"	CARI hires three new professional staff	CARI
"	TA contractor and CARI submits to USAID workplan for calendar year	TA Contractor CARI
Feb '86	PIO/T issued for first external evaluation	USAID (ARD)
"	TA Contractor submits workplan for 1986 to USAID	TA Contractors
"	Construction contract executed and work begins on fisheries facilities	USAID
"	Farmers identified for on-farm trials	CARI/MOA TA Contractor
March '86	Storage building, plant protection lab and machine shed finished	Construction Contractor
"	First order of technical and agricultural equipment and supplies arrives	USAID
April '86	CARI annual report 84-85 completed and goes to press	TA Contractor CARI
"	Technical committee reviews and approves CARI wet season research program	Technical Committee
"	Detailed plans and cost estimates completed for ag. engineering building and library expansion	TA Contractor

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April '86	Fencing material arrives and fence constructed around sensitive research plots	CARI, TA Contractor
May '86	On-farm wet season trials initiated	CARI/MOA TA Contractor
"	Advertising for construction contracts for Ag Engineering and Library expansion	USAID
"	Fisheries facilities completed	Construction Contractor
June '86	PIO/C issued for agricultural, scientific supplies and equipment (TA team develops specification)	TA Contractor USAID (ARD)
"	Wet season research plots planted	TA Contractor CARI
July '86	Construction contract awarded for Ag. Engineering and library expansion	USAID
Aug '86	Five long-term participants sent for training	TA Contractor USAID; CARI
"	First external evaluation held and report submitted	USAID (ARD)
Sept '86	Dry season research planned	TA Contractor CARI
"	Detailed plans developed for plant protection laboratory and tissue culture facility advertised for construction contract	TA Contractor USAID (Engineer)
Nov '86	Ag. Engineering and library expansion completed	Construction Contractor
"	Contract awarded for plant protection laboratory and tissue culture facility	USAID
Dec '86	Wet season research plots harvested and data analyzed	TA Contractor CARI
"	Results of on-farm trials analyzed and CARI research plans adjusted if necessary	CARI/MOA TA Contractor

Dec '86	Second shipment of scientific and agricultural commodities received	USAID (ARD)
"	TA Contractor submits annual report	TA Contract
Jan '87	Soil Chemist Advisor departs, as mechanization advisor arrives	TA Contractor
"	TA Contractor submits annual workplan	TA Contractor
"	Three long-term participants selected and applications sent to appropriate universities (oil palm production, instrument technician, vegetable breeder)	TA Contractor USAID (DP)
"	CARI hires three additional professional staff	CARI
Feb '87	Second shipment of scientific and agricultural supplies and equipment arrives	USAID
"	Dry season research plots planted	TA Team; CARI
"	Dry season on-farm trials planted	CARI/ TA Contractor
March '87	CARI publishes 85-86 annual research report	TA Team; CARI
April '87	Plant protection laboratory and tissue culture facility completed	Construction Contractor
"	PIO/C issued for third shipment of scientific and agricultural supplies and equipment	TA Contractor USAID
May '87	Dry season plots harvested and data analyzed	TA Contractor CARI
"	Dry season on-farm trials harvested, CARI research plans adjusted, if necessary	CARI
"	Technical Committee reviews and approves CARI 87-88 research program	Technical Committee
July '87	Wet season research plots planted	TA Contractor CARI

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July '87	Wet season on-farm trials planted Wet season demonstrations planted	CARI/MOA, TA Contractor
Aug '87	Three long-term participants depart for training.	TA Contractor CARI
Aug '87	Five long-term participants arrive from training	CARI
Sept '87	Third shipment of scientific and agriculture equipment and supplies arrives	USAID; CARI
"	Dry season research planned	TA Contractor CARI
Dec '87	Wet season plots harvested and data analyzed	TA Contractor CARI
"	TA Contractor submits annual report to USAID	TA Contractor CARI
Jan '88	Sociologist advisor departs, legume microbiologist arrives	TA Contractor
"	TA Contractor submits annual workplan to USAID	TA Contractor
"	CARI hires three professional research staff	CARI
	Six long-term participants selected and applications forwarded to appropriate universities	TA Contractor CARI
Feb '88	Fourth PIO/C issued for agricultural and scientific supplies and equipment	TA Contractor USAID
"	Dry season research plots planted	TA Contractor CARI
"	Dry season on-farm trials and demonstrations planted	CARI/MOA TA Contractor
March '88	CARI publishes 86-87 annual research report	TA Contractor CARI
May '88	Technical committee reviews and approves CARI 88-89 research program	Technical Committee
"	Dry season plots harvested and data analyzed	TA Contractor CARI

May '88	Dry season on-farm trials and demonstrations harvested, data analyzed and CARI research plans adjusted if necessary	CARI/MOA TA Contractor
July '88	Wet season plots planted	TA Contractor CARI
July '88	Wet season on-farm trials and demonstrations planted	CARI/MOA TA Contractor
Aug '88	Six long-term participants depart for training	TA Contractor USAID(DP)CARI
"	Fourth shipment of agricultural and scientific equipment and supplies arrives	USAID; CARI
Sept '88	Dry season research plots planted	TA Contractor CARI
Nov-Dec 88	Wet season plots harvested and data analyzed	TA Contractor CARI
	Wet season on-farm trials and demonstrations harvest, data analyzed and CARI research plans adjusted if necessary	CARI/MOA TA Contractor
Dec '88	TA Contractor submits annual report to USAID	TA Contractor
Jan '89	TA Contractor submits annual workplan to USAID	TA Contractor
"	CARI hires two professional research staff	CARI
"	CARI selects 7 long-term participant candidates and submits application	TA Contractor CARI
"	Research coordinator, ag. mechanization and crop breeder long-term advisors depart	TA Contractor
Feb '89	Dry season research plots planted	TA Contractor CARI
"	Dry season on-farm trials and demonstrations planted	CARI/MOA TA Contractor

March '89	CARI publishes 87-88 annual research report	TA Contractor CARI
May '89	Dry season plots harvested and results analyzed	TA Contractor CARI
	Dry season on-farm trials and demonstrations harvested, data analyzed and CARI research plans adjusted if necessary	CARI/MOA TA Contractor
May '89	Technical Committee reviews and approves 89-90 research program	Technical Committee

SCOPES OF WORK FOR T.A. TEAM

I. WEED SCIENTIST

A. Duration

2 years

B. Qualifications

A PhD in Weed Science with a strong physiology bias, and at least five years experience in conducting independent research of recognized high caliber. Familiarity with control measures of an array of weeds; i.e., broad-leaved and monocots, herbaceous and woody.

C. Duties

To work with the Plant Protection Department in evaluating the relative importance of various weed species encountered in Liberia and to assist in the design of implementation of research in the control of such weeds. Assist the farming system group and especially the "no-till" component in interdisciplinary studies. These duties will include:

1. Working with the CARI counterpart in surveying the weed problem as it exists in the various crops nationwide

2. Training extension workers in weed identification so they can assist in the above.

3. Helping in the design of weed control experiments and in the proper use of sprayers, herbicides, etc. used in such research, this to be done in close cooperation with the CARI counterpart.

4. Working cooperatively with other departments and with the farming system and "no-till" programs as they relate to weed control and to land preparation.

5. Establishing herbarium of weed species, and a living demonstration "garden" of weeds, to be used in training extension agents, student of RDI and the University of Liberia, as well as farmers.

6. Development of procedures for obtaining established and new herbicide for use in experimental work.

II. LEGUME AGRONOMIST

A. Duration

2 years

B. Qualifications

A PhD in Plant Science, Agronomy or Horticulture relating to edible legume crops with a strong background in physiology. Needs to have some knowledge of microbiology as it relates to soil borne symbiotic bacteria. A minimum of five years research experience and demonstrated ability to design and implement independent studies. Needs to be able to work as part of an interdisciplinary team.

C. Duties

The legume advisor will work with the CARI counterpart in studying those edible legumes which are of potential importance in the Liberian diet, and also those legume crops with soil building and soil improvement value. In the course of this work the advisor will:

1. Evaluate germplasm and conduct variety yield trials in response to consumer and small farmer needs.

2. Include such species as cowpeas, mung beans, lima beans, kidney beans, ground nuts, wing beans and other species as recommended; in such variety trials.

3. Study the production cycle of each species with the view of defining plant responses at different seasons and for different geographic locations.

4. Determine the effect of symbiotic nitrogen fixing bacteria on performance of the various species.

5. Conduct studies on the soil building capability of an array of legume species selected for that property, for their use in agronomic alternatives to cut and burn agriculture. This to be a component of a cooperative farming systems program.

6. Prepare research and extension material related to the studies listed above.

7. Assist with short courses, field days, off station demonstration and other types of extension training activities in cooperation with the MOA and ADP program.

III. PLANT BREEDER

A. Duration

3 years

B. Qualifications

A PhD degree in Plant Breeding with a minimum of five years research experience in any one of the following specialties; rice/small grains, vegetables, legumes and pulses.

C. Duties

The Plant Breeder will be responsible for advising CARI staff in the Crop Science Department involved in several crops including rice, maize, vegetables, legumes and pulses. Specific responsibilities will include::

1. Assist in planning and organizing breeding programs for major Liberian crops.

2. Implementing an applied plant breeding research program for major crops.

3. Train CARI junior research staff in fundamentals of a plant breeding program.

IV. RUMINANT NUTRITIONIST

A. Duration

2 years

B. Qualifications

A PhD degree in the nutrition of ruminant animals, with a strong biochemistry emphasis. Must have at least five years research experience.

C. Duties

Work with a CARI counterpart in developing research programs with both large (native cattle) and small (sheep and goats) ruminants. Assist in the training of extension workers in the management of such livestock. Specific responsibilities will include:

1. Studying the effect of native forages on performance, such as reproduction and rate of gain.

2. Determination of role of supplemental feeding with root crops, etc. on performance.

3. Evaluating the role of legumes, native and exotic, in the diet.

4. Carrying out all research with cooperation of a CARI counterpart and with the assistance of students from RDI and the Univ. of Liberia.

5. Collaborating with the extension liaison office in training specialist, assisting with field days and implementing on-farm research and demonstration on ruminant livestock.

V. AGRICULTURAL ECONOMIST/FARM MANAGEMENT

A. Duration

7 years

B. Qualifications

A PhD in Agricultural Economics with specialization in farm management or in farming systems research. Must have five years experience in farming systems work, or experience in carrying out farm level surveys in third world countries as a member of a multi disciplinary team.

C. Duties

The position will involve working with a CARI counterpart in the following areas:

1. Participate in the farming system team, to integrate the research of the various units and test the system at the farm level with surveys, trials and evaluation of improved technologies.

2. Cooperate with planning, supervision and implementation of farm level surveys, trials and evaluation of improved technologies.

3. Assist the Extension Liaison officer in organizing and implementing training courses for extension workers.

4. Assist in training counterparts and other staff members, as well as students through use of seminars, workshops, publications, etc.

5. Help with the prompt processing and analysis of the results of farm level surveys, trials and tests conducted by CARI staff, extension workers and other cooperators

VI. SOIL FERTILITY/CHEMISTRY SPECIALIST

A. Duration

2 years

B. Qualifications

A PhD degree in Soil Fertility with a strong background in analytical chemistry and familiarity with soil testing procedures including the latest technology. Requires five years of research experience, and while knowledge of tropical soils is preferred, it is not essential.

C. Duties

To work with a PhD counterpart in Soils in developing a long-range program of research in soil fertility for various eco-zones of Liberia and for a range of crop species. Additionally, to help organize a soil testing service to be offered at CARI for researches, extensions workers and farmers. Specific duties to include

1. Assisting in the installation, operation and management of soil testing service.

2. Advising in the planning and implementation of soils research projects, including prioritizing the research effort.

3. Advising, with the counterpart, on interdisciplinary research involving the Crop Science Department and the farming systems committee.

4. Assisting in soil surveys, both national and local.

5. Helping with farmers field days and with the installation of off-station demonstration plots.

VII. RESEARCH COORDINATOR

A. Duration

4 years

B. Qualifications

A PhD degree in an agricultural discipline with at least five years experience in some aspect of research administration, such as Department Head, Director or Associate Director of Research or director of a branch research station. Work experience in a third-world country desirable.

C. Duties

To serve as counterpart of the CARI Research Coordinator during the period of organization and implementation of a vigorous multidisciplinary research thrust which will have nation-wide impact. Specific duties to include but not be restricted to:

1. Assisting in developing criteria for prioritizing research emphasis at CARI.

2. Helping to create a standardized procedure for research proposal submission and to set policy for peer review.

3. Advising on procedures for expediting the implementation of research activities to make the administration responsive to research needs.

4. Assisting in developing procedures for systematic reporting of research results.

5. Fostering dynamic cooperation with the Univ. of Liberia (CAF) to mobilize the nations research resources.

6. Helping create an appropriate professional climate through encouragement of literature collections, organization of seminars and scheduling of symposia, inter disciplinary conferences, etc.

7. Assisting in a dynamic search for research support from International Centers, donor agencies, commercial firms, etc.

VIII. AGRICULTURAL MECHANIZATION/APPROPRIATE TECHNOLOGY

A. Duration

2 years

B. Qualifications

An MS degree in Agricultural Mechanization or Agriculture Engineering, a minimum of 10 years experience in repair, modification and design of agricultural machinery, and at least four years experience in third world countries. Should possess reasonable skill with agricultural mechinary, shop equipment, welding, foundry, sheet metal layout and fabrication, and woodworking tools. Shop management skills to include budgeting, scheduling research activities, supply inventory and requisition and staff supervision.

C. Duties

To plan, design and test technological innovation which are within the means of the small farmer, and to assist a counterpart and other CARI staff in shop management and equipment maintenance. Specific duties to include:

1. Assisting the various departments of CARI in identifying needs in the area of appropriate technology.

2. Design, construction and testing, in cooperation with a counterpart, of innovation useful to the small farmer, including post-harvest handling of commodities.

3. Assisting CARI staff in the proper operation of machinery and shop equipment and in their preventive maintenance and repair.

4. Help in the installation and management of machine shops and in acquisition of supplies and equipment.

5. Working with the Extension Liaison officer at CARI Field Days and in on-farm demonstrations.

6. Provide input for the farming systems interdisciplinary committee in matters relating to appropriate technology.

7. Assist Maintenance Department in developing maintenance schedules and spare part inventories.

IX. EXTENSION LIAISON OFFICER

A. Duration

8 years

B. Qualifications

A PhD in an agricultural science field and a minimum of five years field experience in third world countries. Several advisors will occupy the position over the ten years of the Project. Recommended specialities to be represented during this period, in sequence, are Animal Science, Plant Protection, Crop Science, and Farm Management. The advisor must have the ability to manage and administer extension activities experience will include demonstrated capability in the planning and implementation of demonstration activities, of applied research, and of training programs for extension officers and farmers. Experience in working cooperatively with researchers and field extension agents is required. Also essential is the motivation to develop interdisciplinary research/extension activities within the linkage framework of CARI, MOA Extension, and the ADP's.

C. Duties

Program planning, design and testing will be a prime responsibility, along with close cooperation in the farming systems research work, which will be an interdisciplinary effort. Duties will also include the development of extension specialist and farmer training programs specifically the incumbent will:

1. Participate in surveys, trials, tests and evaluation of technologies developed for small farmers. This involvement will include the planning and implementation of these activities.

2. Assist in the processing, analysis, and reporting of on-farm surveys, trials and tests conducted by various research units of CARI.

3. Plan new methodology for training programs and help with evaluation of extension training activities of the MOA and the ADP's.

4. Develop a CARI newsletter consisting of abstracts of annual reports presented in a format for farmers, to be distributed to extension workers and interested farmers.

5. Initiate mass media (radio) broadcasts featuring CARI research.

6. Assist in the identification and selection of extension candidates for training, including new graduates of the RDI and CAF.

7. Plan and implement field days and demonstrations for farmers to show research achievements, at CARI and at off-station locations.

X. RURAL SOCIOLOGY

A. Duration

3 years

B. Qualifications

A PhD in Rural Sociology or Anthropology. Must have five years experience in developing countries including work in rural/farm surveys as a member of a multi-disciplinary team.

C. Duties

The position will involve working in Socio-Economic Department as Sociologist, including one-to-two years holding line position in department while counterpart is in training. Duties include:

1. Participate in the farming system team, to integrate the research of the various units and test the system at the farm level with surveys, trials and evaluation of improved technologies.

2. Cooperate with planning, supervision and implementation of farm level surveys, trials and evaluation of improved technologies.

3. Assist the Extension Liaison officer in organizing and implementing training courses for extension workers and in developing recommendations for new extension techniques.

4. Assist in training counterparts and other staff members, as well as students through use of seminars, workshops, publications, etc.

5. Help with the prompt processing and analysis of the results of farm level surveys, trials and tests conducted by CARI staff, extension workers and other cooperators

PROGRAM MORTGAGE IMPLICATIONS

The Agricultural Research and Extension II Project represents a substantial investment of USAID/Liberia resources over the next ten years. The PID approval cable (Paragraph 2.D. of State 25798, included as Annex M) requested that the Mission analyze the project's impact on the Mission's program mortgage.

The table below shows the planned obligation through FY 1990 for the Phase II project as well as those from the Mission's Agricultural Rural Development and Nutrition (ARDN) account and Development Assistance (DA) Funding as a whole. (FY 1990 is the last year covered in the FY 1986 ABS planning period.)

After the initial FY 1984 obligation, the Phase II project accounts for about 35 percent of ARDN obligations and 14 percent of total DA obligations. This does not represent a mortgage problem if the importance of the project to the Mission's program is considered. As Section II of the Project Paper points out, agriculture is the priority sector in the Mission's medium- and long-term strategy adopted in the FY 1985 CDS. Within the sector, research is the top priority. Thus, committing a third of ARDN funds to this area is not excessive. Other activities to be funded by this account are Rural Development Training II (FY 1985 start), Road Maintenance (FY 1985 start), Nimba County Rural Technology (ongoing) and Crop Storage and Handling (FY 1986 start). Sufficient funding should be available in FY 1987 for a major new start such as an extension project to complement the agriculture research effort.

Planned CARI Obligations and Program Mortgage Implication

(in $ 1,000s)

	Fiscal Year						
USAID/Liberia Obligation	1984	1985	1986	1987	1988	1989	1990
CARI	3180	1626	2660	2230	1990	2300	2190
ARDN	7330	5926	7210	5663	5790	6200	6000
Development Assistance	12967	14500	16000	16000	16000	16000	16000
CARI Obligations							
As percent of ARD	43	27	37	39	34	37	36
As percent of Development Assistance	25	11	17	14	12	14	14

ANNEX M

ACTION: AID 5 INFO: AMB DCM ECON 8/EV

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RR RUEHMV
DE RUEHC #5798/01 0271106
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TO AMEMBASSY MONROVIA 7931
BT
UNCLAS STATE 025798

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CN: 58492
CHRG: AID
DIST: ALL

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E.O. 12356: N/A
TAGS:
SUBJECT: LIBERIA AGRICULTURE RESEARCH AND EXTENSION PHASE II (669-0188) - ECPR REPORTING CABLE

REF: STATE 021396

1. AS NOTED IN REFTEL, THE PID FOR THE SUBJECT PROJECT WAS APPROVED AT THE ECPR MEETING ON JANUARY 18, 1984.

2. THE ECPR FULLY ENDORSED THE MISSION'S PLAN TO PROVIDE CONTINUED SUPPORT TO AGRICULTURAL RESEARCH AND EXTENSION IN LIBERIA BUT, AS NOTED IN THE PID ISSUES PAPER PROVIDED TO THE MISSION, THERE ARE A NUMBER OF DESIGN/IMPLEMENTATION QUESTIONS WHICH THE MISSION AND PP DESIGN TEAM NEED TO ADDRESS. THE FOLLOWING ARE THE PRINCIPAL FINDINGS AND RECOMMENDATIONS OF THE ECPR.

A. BECAUSE AID HISTORICALLY HAS HAD ONLY MIXED SUCCESS IN LIBERIA IN PROVIDING LONG TERM SUPPORT TO THE AGRICULTURAL SECTOR IN RESEARCH, EXTENSION AND INSTITUTIONAL DEVELOPMENT, THE ECPR DECIDED A TIGHTER DESIGN AND IMPLEMENTATION PLAN NEEDED TO BE DEVELOPED WHICH WOULD USE SOCIO/ECONOMIC DATA AS THE BASIS FOR SETTING FIRM PARAMETERS FOR THE RESEARCH AND EXTENSION COMPONENTS OF THE PROJECT, I.E., WHICH WOULD CLARIFY THE SCOPE AND FOCUS OF RESEARCH AND EXTENSION PROGRAMS. FOR THIS REASON IT WAS AGREED THAT THE MISSION WOULD BEGIN THE SOCIO-ECONOMIC ANALYSIS DURING THE PP DEVELOPMENT IN ORDER TO DEFINE THE TYPE/KIND OF RESEARCH NEEDED WHICH WOULD HAVE A DIRECT EFFECT ON THE FOOD PRODUCTION/CONSUMPTION OF SMALL FARM FAMILIES AND ON IDENTIFYING MARKETABLE COMMODITIES. THE LAND TENURE SITUATION SHOULD BE A SPECIFIC VARIABLE EXAMINED IN THE COURSE OF THIS ANALYSIS. THE STUDY WOULD ALSO ADDRESS THE ROLE OF WOMEN IN DEVELOPMENT IN THE PROJECT. FUNDING FOR THE SOCIO-ECONOMIC STUDY COULD BE OBTAINED FROM THE PHASE I PROJECT. IN ADDITION TO THE SOCIO-ECONOMIC ANALYSIS PLANNED PRIOR TO AND FOLLOWING THE AUTHORIZATION, THE ECPR RECOMMENDED THAT A NUTRITIONAL CONSULTANT BE PROVIDED NOW TO ASSIST THE PP TEAM IN ITS DESIGN OF THE PROJECT. DETAILS ON THE

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INPUTS TO BE PROVIDED BY THE NUTRITIONAL ADVISOR AND INFORMATION REGARDING THE FUNDING FOR THE ADVISOR FROM S AND T RESOURCES WILL BE COVERED BY A SEPARATE CABLE FROM AFR/TR/ARD.

B. THE SECOND ITEM WHICH WAS EXTENSIVELY DISCUSSED DURING THE ECPR WAS THE NEED TO MORE COMPREHENSIVELY AND ACTIVELY ADDRESS THE EXTENSION LINKAGES BETWEEN THE RESEARCH ACTIVITIES PROPOSED AND THE TARGET FARMERS. TWO ASPECTS OF THIS SUBJECT WERE CONSIDERED IMPORTANT FOR THE MISSION TO DEAL WITH: 1) DEVELOPMENT DURING THE PP DESIGN OF A STRATEGY IDENTIFYING HOW THE CRITICAL AREA OF EXTENSION CAN BE MORE EFFECTIVELY ADDRESSED THAN IS PROPOSED IN THE PID (SUBJECT OF COURSE TO RECOGNIZED RESOURCE CONSTRAINTS); AND 2) INCLUSION IN THE PROJECT OF AN EXTENSION COMPONENT WHICH WOULD ENSURE THAT TO THE DEGREE AND EXTENT FEASIBLE, RESEARCH RESULTS AND TECHNOLOGY READY FOR APPLICATION WILL BE TRANSFERRED TO AND IMPLEMENTED BY THE TARGET FARMERS. THE ECPR RECOGNIZED THAT IT WOULD NOT BE POSSIBLE TO PROVIDE SUPPORT FOR A NATIONAL EXTENSION SERVICE DEVELOPMENT PROGRAM BUT IT STRONGLY FELT THAT THERE WAS AN URGENT NEED FOR THE MISSION TO INCLUDE ADDITIONAL EXTENSION DEVELOPMENT AND EXPERIMENTATION ACTIVITIES WITHIN THIS PROJECT. AS A BEGINNING, THE ECPR RECOMMENDED THAT THE MISSION AND PP DESIGN TEAM WORK WITH THE ON-GOING EXTENSION SERVICES FINANCED BY AID AND OTHER DONORS IN NIMBA, BONG AND LIMBA COUNTIES IN THE EXTENSION DESIGN. ALSO, THERE WAS A CONSENSUS THAT THE MISSION SHOULD FULLY CONSIDER THE POSSIBILITY OF INCORPORATING/UTILIZING THE SERVICES OR PROGRAMS OF PVOS/NGOS--INCLUDING PARTICULARLY PRIVATE SECTOR FIRMS--TO THE DEGREE FEASIBLE IN AN EFFORT TO EXPERIMENT WITH VARIOUS EXTENSION DELIVERY SYSTEMS IN ADDITION TO THE GOL EXTENSION SERVICE. THE ECPR RECOGNIZED THAT THE TOTAL EFFECT OF MEASURES SUCH AS THESE WOULD STILL FALL SHORT OF A NATIONAL EXTENSION SERVICE DEVELOPMENT PROGRAM, BUT CONCLUDED IT WAS ESSENTIAL THAT MORE CONCERN FOR HOW TO DELIVER TECHNOLOGY GENERATED BY THE RESEARCH SYSTEM BE INCORPORATED INTO THE PROJECT AND THAT EXPERIMENTATION WITH PRIVATE ALTERNATIVES BE UNDERTAKEN. THERE WAS A CONSENSUS THAT THE DESIGN WOULD NEED TO ASSURE SUFFICIENT FUNDS FOR THIS INCREASED EMPHASIS.

C. THE PP DESIGN TEAM SHOULD FOCUS ON HOW TO STRENGTHEN THE MANAGEMENT/INSTITUTIONAL CAPACITY OF CARI (CENTRAL AGRICULTURAL RESEARCH INSTITUTE) REGARDING THE USE OF MANPOWER NOW TRAINED AND THE TYPE OF TRAINED PROFESSIONALS CARI WILL NEED IN THE FUTURE. TO A DEGREE, THE SOCIO/ECONOMIC STUDIES WILL HELP

DETERMINE THE FUTURE NEEDS OF CARI.

- D. IN PROPOSING THE SUBJECT 10 YEAR PROJECT BOTH AID AND THE GOL ARE MAKING A SUBSTANTIAL COMMITMENT TO AGRICULTURAL RESEARCH AND EXTENSION TO BENEFIT THE SMALL FARMER. FOR AID A DOLS. 19.9 MILLION PROJECT REPRESENTS A HEAVY MORTGAGE ON THE FUTURE AID PROGRAM FOR LIBERIA. FOR THE GOL THEIR PROPOSED INPUTS OF DOLS. 33.0 MILLION REPRESENTS A LARGE RECURRENT COST DURING THE 10 YEAR LIFE OF THE PROJECT AND A HIGHER COST THEREAFTER. THE PP SHOULD SHOW THAT THE MISSION HAS ANALYZED ITS MORTGAGE PROBLEM ASSOCIATED WITH THE PROJECT AND THAT THE GOL IS FULLY AWARE OF ITS RECURRENT COST COMMITMENT AND WILL PROVIDE THE NECESSARY FUNDS FOR THIS PROJECT ON AN ANNUAL BASIS.

- E. TO MONITOR THE POLICY CHANGES/DEVELOPMENT OVER THE 10 YEAR LIFE OF THE PROJECT, THE ECPR RECOMMENDED THAT THE PP DESIGN TEAM ESTABLISH BENCHMARKS/EVALUATION POINTS, POSSIBLY ON AN ANNUAL BASIS, TO MEASURE IN CONCRETE TERMS IMPROVEMENTS IN INSTITUTIONAL DEVELOPMENT, RESEARCH AND EXTENSION. AN INTENSIVE EVALUATION WOULD BE MADE PRIOR TO THE FIFTH YEAR OF THE PROJECT WHICH WOULD DETERMINE WHETHER TO CONTINUE, REDESIGN OR OTHERWISE MODIFY THE PROJECT.

F. THE ECPR RECOMMENDED A SUBSTANTIAL INCREASE IN THE LEVEL OF SHORT TERM TA AND SOME CHANGES IN THE TYPE OF LONG TERM TA. AFR/TR/ARD WILL PROVIDE MISSION THEIR THOUGHTS ON THIS POINT WHICH INCLUDES A NEED FOR A SOCIAL SCIENTIST ON A LONG TERM BASIS.

- G. THE IEE NEEDS TO BE AMENDED IF THERE ARE PLANS TO USE PESTICIDES IN NON-CONTROLLED DEMONSTRATION AREAS OUTSIDE OF THE RESEARCH STATIONS.

- H. THE ECPR AGREED WITH THE MISSION STRATEGY TO SELECT A CONTRACTOR FROM AMONG THE TITLE XII UNIVERSITIES PROVIDED THE PERSONNEL ARE SELECTED PRIMARILY FROM THE UNIVERSITY STAFF. THE IMPORTANCE OF DEVELOPING A LONG TERM RELATIONSHIP BETWEEN CARI AND THE TITLE XII UNIVERSITY WAS NOTED BY THE BIFAD REPRESENTATIVE. THE POSSIBILITY OF INCLUDING A PRIVATE SECTOR FIRM OR PVO AS A SUBCONTRACTOR TO THE TITLE XII UNIVERSITY IS A POINT WHICH THE MISSION MAY WISH TO CONSIDER IN DESIGNING THE PROJECT TO SUPPLEMENT THE EXPERTISE OF THE UNIVERSITIES.

3. REQUEST MISSION COMMENTS ON FINDINGS/ RECOMMENDATIONS OF ECPR AND CONFIRMATION OF MAY/JUNE 1984 OBLIGATION DATE. SHULTZ
PT
#5798

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ANNEX N

UNITED STATES GOVERNMENT

memorandum

DATE: August 29, 1984

REPL. TO ATTN OF: Robert C. Bragg, Engineer

SUBJECT: Project 669-0188, Agricultural Research and Extension II, Foreign Assistance Act of 1961, as amended, Section 611(a)

TO: Lois Richards, Director

I have examined the information contained in the project paper and find it meets the requirements of Section 611(a) of the Foreign Assistance Act of 1961, as amended.

I certify that the construction cost breakdown of the construction elements, i.e., staff housing, laboratories, additional research and administrative buildings and extensions, fish research ponds, fencing and electrical generation expansion, as shown in Annex G, are reasonable.

The final plans, specifications and bid documents will be reviewed and approved by the USAID engineer prior to obligation, and competitive bids will be received from local contractors for construction.

OPTIONAL FORM NO. 10
(REV. 1-80)
GSA FPMR (41 CFR) 101-11.6
5010-111

☆ U.S. GOVERNMENT PRINTING OFFICE : 1982 O - 361-526 (7290)

ANNEX O

CERTIFICATION PURSUANT TO SECTION 611(e)

OF THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I hereby certify to the Administrator of the Agency for International Development that the Government of Liberia (GOL) possesses both the financial and human resources to effectively maintain and utilize the Agricultural Research and Extension II Project to be undertaken pursuant to the terms of the A.I.D. grant between the Government of Liberia and the United States of America for the purpose of developing improved technological packages for food and cash crops and livestock to meet the needs of small farmers. In so certifying I have taken into account the maintenance and utilization of projects in Liberia financed and assisted by the United States of America, and I have more particularly taken into account the demonstrated capability of the GOL to effectively utilize development projects of this nature.

Date: August 31, 1984

Lois Richards

Lois Richards

Director, USAID/Liberia

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STATUTORY CHECKLIST

COUNTRY CHECK LIST

This check list was completed at the begining of the FY 84 by USAID/ Liberia and included in the Program Assistance Approval Document (PAAD, 669-1C-606 Project 669-0189) Authorization date, December 30, 1983. No negative findings were reported at the time and no changes have occurred to date.

5C(1) - COUNTRY CHECKLIST

Listed below are statutory criteria applicable generally to FAA funds, and criteria applicable to individual fund sources: Development Assistance and Economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBLITY

1. FAA Sec. 481. Has it been determined that the government of the recipient country has failed to take adequate steps to prevent narcotic drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully? — No.

2. FAA Sec. 620(c). If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) the debt is not denied or contested by such government? — No such case exists for Liberia

3.	FAA Sec. 620(e)(1) If assistance is to a government, has it (including 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. The GOI has taken no such action.
4.	FAA Sec. 532(c), 620(a), 620(f), 620D; FY 1982 Appropriation Act Secs. 512 and 513. Is recipient country a Communist country? Will assistance be provided to Angola, Cambodia, Cuba, Laos, Vietnam, Syria, Libya, Iraq, or South Yemen? Will assistance be provided to Afghanistan or Mozambique without a waiver?	No.
5.	ISDCA of 1981 Secs. 724, 727 and 730. For specific restrictions on assistance to Nicaragua, see Sec. 724 of the ISDCA of 1981. For specific restrictions on assistance to El Salvador, see Secs. 727 and 730 of the ISDCA of 1981.	N/A
6.	FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction by mob action of U.S. property?	No.

7.	FAA Sec. 620(l). Has the country failed to enter into an agreement with OPIC?	No. Liberia has an Investment Guaranty Agreement with the U.S.
8.	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 activities in international waters? (b) If so, has any deduction required by the Fishermen's Protective Act been made?	No.
9.	FAA Sec. 620(q); FY 1982 Appropriation Act Sec. 517. (a) Has the government of the recipient country been in default for more ~~than~~ six months on interest or principal of any AID loan to the country? (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 appropriation bill appropriates funds?	(a) No (b) No
10.	FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the amount of foreign exchange or other resources which the country has spent on military equipment? (Reference may be made to the annual "Taking into	N/A

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.)

11. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?

No.

12. 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 AID Administrator in determining the current AID Operational Year Budget? (Reference may be made to the Taking into Consideration memo.)

Liberia is not in arrears in U.N. obligations. ?

13. FAA Sec. 620A; FY 1982 Appropriation Act Sec. 520. Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed an act of international terrorism? Has the country aided or

No.

abetted, by granting sanctuary from prosecution to, any individual or group which has committed a war crime?

14. FAA Sec. 666. 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.

15. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? 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, after August 3, 1977? (FAA Sec. 620E permits a special waiver of Sec. 669 for Pakistan.) — No.

16. 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 Session of the General Assembly of the U.N. of Sept. 25 and 28, 1981, and failed — No.

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.)

17. ISDCA of 1981 Sec. 723. See special requirements for assistance to Haiti. N/A

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria. No.

a. 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?

2. Economic Support Fund Country Criteria No.

a. FAA Sec. 502B. Has it been determined that the country has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, has the country made such significant improvements in its human rights record that furnishing such assistance is in the national interest?

b. ISDCA of 1981, Sec. 725(b). If ESF is to be furnished to Argentina, has the President certified that (1) the Govt. of Argentina has made significant progress in human rights; and (2) that the provision of such assistance is in the national interests of the U.S.? N/A

c. ISDCA of 1981, Sec. 726(b). If ESF assistance is to be furnished to Chile, has the President certified that (1) the Govt. of Chile has made significant progress in human rights; (2) it is in the national interest of the U.S.; and (3) the Govt. of Chile is not aiding international terrorism and has taken steps to bring to justice those indicted in connection with the murder of Orlando Letelier? N/A

5C(2) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance Funds, B.2. applies to projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 1982 Appropriation Act Sec. 523; FAA Sec. 634A; Sec. 653(b).

   (a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that amount)?

   (a) A Congressional Notification was sent to the Congress on June 6, 1984. The waiting period expired on June 21, 1984, without objection from Congress.

   (b) Yes

2. FAA S. 611(a)(1). Prior to obligation in excess of $100,00, will there be

	(a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	(a) Yes. (b) Yes.
3.	FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	N/A
4.	FAA Sec. 611(b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 19737 (See AID Handbook 3 for new guidelines.)	N/A
5.	FAA Sec. 611(e). If project is capital assistance (e.g., construction) and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	Yes

6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and 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) It will promote the expo of tropical cash crops by developing improved technology for their production. (b) No effect (c) No effect (d) No effect (e) It will increase the productivity and efficiency of small farmers.
8. 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).	This project will provide U.S. technical assistance and commodities. Most of these inputs will be obtained in the U.S. Project will have no direct effect in encouraging U.S. private trade and investment abroad

9.	FAA Sec. 612(b), 636(h); FY 1982 Appropriation Act Sec. 307. 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.	GOI contr[illegible] activity will be assured through normal budget allocations.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have be n made for its release?	No.
11.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12.	FY 1982 Appropriation Act Sec. 521. 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?	No
13.	FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does	Yes.

the project or program take into consideration the problem of the destruction of tropical forests?

14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)? — N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b), 111, 113, 281(a). 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, spreading investment out 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 the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and

(a) The project will increase the economic participation of small farmers who constitute 70 percent of the nation's work force by developing more productive agricultural technologies for food and cash crops. This, in turn, should foster the growth of rural processing and service industries.

(b) No direct effect

otherwise 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 and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?	(c) No direct effect (d) Women constitute a major portion of the farming population. The project, through its farming systems research and extension component, will examine how women farmers can benefit from improved agricultural technologies. (e) No direct effect
b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?	Yes
c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	The project will develop technologies appropriate to the social, economic and environmental context of the small farmer.
d. FAA Sec. 110(a). Will the recipient country provide at least 25% 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

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"? (M.O. 1232.1 defined a capital project as "the construction, expansion, equipping or alteration of a physical facility or facilities financed by AID dollar assistance of not less than $100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character.

f. FAA Sec. 122(b). 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?

The project will increase the productivity of the smallholder farming sector.

g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage

The project will utilize participant training and technical assistance to develop Liberia's institutional capacity to conduct agricultural research suited to its particular social, economic and environmental needs.

institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.

2. Development Assistance Project Criteria (Loans Only) N/A

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.

b. 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% of the enterprise's annual production during the life of the loan?

c. ISDCA of 1981, Sec. 724 (c) and (d). If for Nicaragua, does the loan agreement require that the funds be used to the maximum extent possible for the private sector? Does the project provide for monitoring under FAA Sec. 624(g)?

3. Economic Support Fund Project Criteria N/A

a. FAA Sec. 531(a). Will this assistance promote economic or political

stability? To the extent possible, does it reflect the policy directions of FAA Section 102?

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities?

c. FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives?

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

5C(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	The USAID mission will explore awarding the procurement services contract under a set-aside program.
2. FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?	Yes
3. 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?	Yes
4. FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If offshore procurement of agricultural commodity or product is to be	N/A

	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.)	
5.	FAA Sec. 604(a). Will construction or engineering services be procured from firms of countries otherwise - eligible under Code 941, but which have attained a competitive capability in international markets in one or these areas?	No
6.	FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum 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 that such vessels are avail ble at fair and reasonable rates?	No
7.	FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? If the facilities of other	The primary T.A. contract will be awarded under Title XII. Other T.A. will be contracted to private firms or individuals.

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	Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?	
8.	International Air Transport, 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
9.	FY 1982 Appropriation 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?	It will.
B.	Construction	N/A
1.	FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services to be used?	
2.	FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?	Yes

3. 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 CP)? — Yes

C. Other Restrictions

1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter? — N/A

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administed by an international organization, does Comptroller General have audit rights? — N/A

3. 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

4. Will arrangements preclude use of financing:

a. FAA Sec. 104(f); FY 1982 Appropriation Act Sec. 525: (1) To pay for performance of abortions as a method of family — Yes

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[illegible] coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; (4) to lobby for abortion?	
b. FAA Sec. 620(o). To compensate owners for expropriated nationalized property?	Yes
c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs?	Yes
d. FAA Sec. 662. For CIA activities?	Yes
e. FAA Sec. 636(i). 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
f. FY 1982 Appropriation Act, Sec. 503. To pay pensions, annuities, retirement pay, or	Yes

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adjusted service compensation for military personnel?

g. FY 1982 Appropriation Act, Sec. 505. To pay U.N. assessments, arrearages or dues? — Yes

h. FY 1982 Appropriation Act, Sec. 506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)? — Yes

i. FY 1982 Appropriation Act, Sec. 510. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields? — Yes

j. FY 1982 Appropriation Act, Sec. 511. Will assistance be provided 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

k. FY 1982 Appropriation Act, Sec. 515. To be used for publicity or propaganda purposes within U.S. not authorized by Congress? — Yes

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ANNEX Q

WAIVER JUSTIFICATION

Waiver Requirement: A procurement source/origin waiver is required from Geographic Code 000 (U.S. only) to Geographic Code 935 (Special Free World) for the purchase of ten trail motorbikes and spare parts valued at $15,000.

1. Cooperating Country:	Liberia
2. Project:	Agricultural Research and Extension II (669-0138)
3. Nature of Funding:	Grant
4. Description of Commodities:	Ten trail motorbikes (100 to 125 cc displacement) plus spare parts
5. Approximate Value:	$15,000
6. Probable Source:	Liberia
7. Probable Origin:	Japan

Discussion: The Agricultural Research and Extension II project will assist the Central Agricultural Research Institute (CARI) in developing its capability to identify the needs of subsistence farmers, generate improved technologies responsive to these needs through adaptive research, and communicate these technologies to institutions that can extend them to farmers. An essential element of this project will be the creation of a Department of Socio-Economic Research at CARI to conduct farming systems research and extension (FSR/E). The Socio-Economic Department staff will make frequent visits to farms in numerous scattered, remote locations to conduct socio-economic surveys of farmers and monitor on-farm trials. Owing to the poor quality of Liberian roads, the limits of the road network, the high cost of fuel and the difficulty in operating and repairing motor vehicles in remote areas, light trail bikes (100-125 cc displacement) offer the only reliable, efficient and effective way to transport survey personnel. Such motorbikes have been used in the AID-assisted Lofa County Rural Health project and by other GOL entities.

Section 636(i) of the Foreign Assistance Act of 1961, as amended, describes special conditions which justify waiving the requirement that vehicles for development assistance projects be manufactured in the U.S. One of these special circumstances is the inability of U.S. manufacturers to provide a particular type of necessary vehicle, or the lack of adequate repair facilities and spare parts for U.S. manufactured vehicles. Handbook 1,

Supplement B, Chapter 4C2d sets forth an additional requirement that project vehicles be of U.S. source/origin unless one of seven criteria for granting a waiver is met. One of these criteria is that the particular commodity required is unavailable.

The type of motorbike needed for project implementation is a 100 to 125 cc trail motorbike, which is not available from motorcycle manufacturers in the United States. U.S.-manufactured motorcycles are heavier, more powerful, more expensive, and unsuitable for the purpose of this project. Moreover, there is no representative of U.S. manufactured motorcycles in Liberia for repairing U.S.-made motorcycles and providing spare parts. There are presently Suzuki, Honda and Yamaha dealerships in Liberia; maintenance/repair services, and spare parts are available for these types of motorbikes. However, to insure the availability of adequate spare parts at CARI, a supply equivalent to 25 percent of the purchase cost of the motorbike is advisable.

Delegation of Authority 140, Revised, authorizes you to waive source/origin requirements for motor vehicles for transactions of less than $50,000.

Recommendation: Based on the justification above, it is recommended that you (1) determine that special circumstances exist to justify waiving the requirement to procure U.S. manufactured vehicles under FAA Section 636(i); (2) certify that exclusion of procurement of motor vehicles from free world countries, other than the cooperating country and countries included in AID geographic code 941, would seriously impede the attainment of U.S. foreign policy objectives of the foreign assistance program; and (3) waive the source/origin requirements set forth in Handbook 1, Supplement B, to permit the procurement of ten trail motorbikes and spare parts from countries included in geographic code 935.

Approved: [signature]

Disapproved: _____

Date: August 31, 1984

Clearances:
A/DP:ECostello Draft
SPPD:DKline [illegible]
CON:RLeonard Draft
EO:RRawley Draft

ASSESSMENT OF CARI RESEARCH CAPABILITIES AND NEEDS

A. CROP SCIENCE

1. Capabilities and Resources

The Crop Science Department is at present the one most capable of performing quality research. This is especially true of the field crops division, and with the return of staff now in training, will also be true of the rice division. This is not to say, however, that additional inputs are not needed. Considerable expansion of this department's capabilities, particularly in the areas of tree crops, production agronomics of rice and field crops, and in the area of legumes as human food forage and green manures, is needed.

a. Personnel

- Dr. Sizi Morris, Ph.d., Plant Breeder and Head of Department

1) Rice Division

- Mr. Roland C. Massaquoi, (Ph.D.) Rice Breeder, on study leave, to return 1986

- Mr. Francis Sumo, (M.S.) Agronomist, on study leave, to return 1984

- Mr. William Massaquoi, (M.S.) Crop Physiologist on study leave, to return 1984

2) Field Crops Division

- Mr. David Wounuah, M.S., Root and Tuber Agronomist

- Mr. Mallik AS-A Saqui, (M.S.), Root and Tuber Agronomist

- Dr. Sizi Morris, Ph.D., Maize Breeder

- Wilson Kagabo, (M.S.), Legume/Pulse Agronomist. On study leave to return September 1985

- D.R. Pandey, M.S., FAO Vegetable Advisor, to depart June 1984

- Philip Kamanda, B.S., Vegetable Crops

- Walford Jones, M.S., Vegetable Crops

- James Freeman, Plant Propagation

- Maran Sherman, B.S., Coffee and Cocoa

- William Swen, M.S., Citrus Crops on study leave to return 1984

3) Post Harvest/Seed Technology.

- J. Wleh Wilson, RDI

- Edna Johnson, RDI

b. Facilities

Facilities available to this department are most inadequate, in terms of space and the suitability of that space for research. This situation will be partially rectified with the completion of the new Crop Laboratory now under construction. However, this building alone will not be able to meet all the needs of the department. Need exists for office and work space for vegetable and pulse work, and maize and rice cleaning and storage.

Two specific needs are suitable greenhouse and screen house facilities for plant propagation, and a cold storage for seed. These are major constraints limiting the activities of the rice and field crops division and cooperative work with land and water resources.

One other problem is the lack of a fertilizer and chemical storage facility which can be used to store materials for extended periods. With the heat and humidity, shelf life of stored products is shortened. An adequate storage facility would allow for more efficient procurement and usage of expensive imported products.

c. Equipment

At the present time only a limited amount of equipment and supplies are available to the Crop Science Department. This has inhibited field operations somewhat and has been a major limitation of backup laboratory work. Operations such as routine quality evaluation of new rice, cassava sweet potato and vegetable varieties are not done as a result. Multiplication of improved cassava ADP's and sweet potato for release to extension and has also been hampered.

d. Status of Current Research

The Crop Science Department has undertaken an impressive amount of research, particularly in the areas of plant breeding and variety development. This work has been closely tied to international centers such as the International Rice Research Institute (IRRI) and International Institute for Tropical Agriculture (IITA). Linkages also exist with organizations such as WARDA, Partnership for Productivity (PfP) and the county Agricultural Development Projects (ADP) in Bong, Lofa and Nimba Counties, and to other Departments of CARI.

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Following is a list of research currently underway, or proposed:

1) Rice Division

- National Rice Observation Nursery
- F Generation Nursery for upland varieties
- Elite Line Medium Scale Trial
- Multilocational trials of advanced selections
- NPK rate studies
- Mineral nutrition of rice
- Date of harvest trials of upland and swamp rice

2) Root and Tuber Crops

- Screening of cassava germplasm
- Multilocational trials of advanced cassava selections
- Effect of number of cuttings per hill on cassava yields
- Effect of leaf harvest on cassava root yields
- Weed control in cassava
- Effect of intercropping on productivity of cassava
- Date of planting studies
- Cassava fertilizer trials

3) Maize

- Maize breeding nursery
- Maize population improvement
- Maize variety testing
- Maize half-sib evaluation

4) Vegetables

- Variety trails on Chinese cabbage, cabbage, onion, tomato, eggplant, okra, hot pepper and bitter ball
- Seed multiplication of okra, hot pepper and bitter ball

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- Spacing trial on eggplant

- Fertilizer trial on eggplant

2. Direction of Future Research

While an excellent start has been made in research of concern to Liberian Agriculture, additional efforts are needed, particularly in production agronomy and crop management.

A long-term goal of the Crop Science Department should be to develop alternatives to the traditional slash-and burn system now being used. This should allow for more intensive cropping, while minimizing costly inputs when at all possible. It should also aim to minimize erosion on these fragile soils. Increased work in maize, legumes and vegetable management, should identify a place for them as human foods, animal feed or green manures, in both uplands and swamps. An interdisciplinary task force should be organized under the CARI Director or his designated representative to coordinate the multiple disciplines involved in the development of technologies for continuous cropping systems. Another area which merits increased research is production and management of tree crops, particularly coffee, cocoa and oil palm which have potential for increased exports.

A third area of research is the evaluation of potential crop varieties for their consumer acceptance or quality. While much effort has been expanded in testing lines for increased yield and improved disease and pest resistance, little has been done to evaluate them for nutritional quality or consumer acceptance. This should receive attention particularly as Liberian agriculture moves away from traditional subsistence production and toward a cash market system.

3. Needed Inputs

a. Personnel

1) New Staff - The following positions should be established in the Crop Science Department:

Priority 1 - To be established in the first years of Phase II with training initiated as soon as possible:

- Agronomist, M.S. level, to supervise off-station testing of rice varieties, and maintain pure seed stocks of improved varieties

- Root Crop Breeder, M.S. or Ph.D. level, to improve cassava, sweet potato and cocoyam

- Tissue Culture Propagationist, M.S. level, for the rapid multiplication of improved varieties for release to extension and the public

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- Vegetable Production Specialist, M.S. level, to screen AVRDC lines and produce pure seed of adapted varieties

- Oil Palm production agronomist, M.S. level

Priority 2 - Positions which should be established and training initiated after those in priority 1, but prior to midpoint of Phase II:

- Root Crop Agronomist, at M.S. level, to supervise off-station testing and maintain pure stocks of improved lines

- Maize Agronomist, at M.S. level, to study maize production systems

- Tropical tree fruit production specialist, at M.S. level

- Tree Crops Propagation Specialist

Priority 3 - Positions which might be established and training completed prior to close of project Phase II:

- Rice Geneticist, at Ph.D. level

- Maize Breeder, at Ph.D. level

- Legume and Pulse Breeder, at Ph.D. level

2) Training - In addition, the following training of existing staff should be initiated (in priority order):

- M.S. training in tree crop production for Ms. Maran Sherman, followed by 6-12 months training in coffee and cocoa at an international or national research center

- B.S. Training in seed technology at Mississippi State University for Mr. Wleh Wilson

- Ph.D. training in crop physiology or plant breeding for Mr. David Wounuah

- M.S. training in vegetable production for Mr. Philip Kamanda

3) End of Project Staffing - At the end of this project, the Crop Science Department should be composed of the following positions:

- Head of Department

Rice Division

- Rice Geneticist
- Rice Breeder
- Rice Production Agronomist
- Rice Physiologist
- Off-station Testing Agronomist

Field Crops

- Root and Tuber Physiologist
- Root and Tuber Agronomist
- Root and Tuber Breeder
- Root and Tuber Tissue Culture and Propagation
- Maize Production Agronomist
- Maize Breeder
- Legume/Pulse Agronomist
- Legume/Pulse Breeder
- Vegetable Variety Testing
- Vegetable Production
- Vegetable Breeding/Seed Production
- Seed Technologist

Tree Crops Division

- Citrus Production Specialist
- Coffee/Cocoa Production Specialist
- Oil Palm Production Specialist
- Tropical Tree Fruit Production Specialist

b. Facilities - The following improvements in or additions to facilities available to the Crop Science department should be considered (listed in priority order):

1) Completion of the new Crop Science building under Phase I

2) Completion of the propagation building under Phase I, with the addition of space for tissue culture at one end during the second phase project

3) Construction of quality long-term seed storage facilities under Phase I

4) Renovation of existing facilities to produce space for rice processing, maize and vegetable laboratories

5) Construction of a storage facility for fertilizers and agriculture chemicals with appropriate humidity quality of stored products under Phase II

6) Construction of a green house for use by Crop Science and Land and Water Resources for pot experiments

c. Advisors - The following advisors, both long and short-term are recommended for consideration:

1) Short-term (1 month) to assist in development of propagation/tissue culture facility

2) Short-term (2 months) to assist in initial starting of seed storage facility

3) Short-term (1 month) to assist in planning research programs in tropical fruits

4) Short-term (3 months) for agronomist/ Plant Breeder in item 5 for follow up consultation one month each year following the long-term assignment

5) 3-year agronomist/Plant Breeder to assist in varietal improvement and cultural practice development for major cereal, root and vegetable crops (FY 86-88)

B. LAND AND WATER RESOURCES

1. Capabilities and Resources

The land and Water Resources Department is getting organized with the return of most staff members from study leave. It should be in position to make significant contributions shortly. The resources available include a core of well trained, motivated young Liberians, and a soon to be completed analytical laboratory. Every effort should be made to promote the development of this group.

a. Personnel

- Dr. Charles Mulbah, Ph.D., Soil Fertility and Chemistry and Head of the Department

- Mr. John K. Jallah, M.S., Soil Fertility
- Mr. James K. Harris, M.S., Soil Chemistry on study leave in U.S.
- Mr. Pofinema Gweama, B.S., Soil Fertility/Plant Nutrition
- Mr. Peter Korvah, M.S., Soil Survey and Air-photo Interpretation
- Mr. Flexchman A. Pedersen, Diploma, Meterologist
- Mr. Melville Harding, B.S., Soil Microbiology
- Mr. James S.K. Marwolo, B.S., Soil Chemist, Head of Laboratory
- Mr. Mauricima Dolley, B.S., Soil Chemist

b. Facilities

The facilities available to the department are totally inadequate. This will be partially corrected with the completion of the new analytical laboratory. However, appropriate laboratory and office space will still be needed for the soil survey and Ag-meterology groups. This will be especially important if the proposed National Soil Survey is implemented in the next year, in which case additional space will be needed.

c. Equipment

The analytical laboratory is fairly well equipped but benches and furniture are needed for the new building. Since the soil fertility, microbiology and chemistry groups rely heavily on this laboratory, their needs are reasonably well served. There are no greenhouse facilities for such things as solution culture, which presents a serious problem.

The Soil Survey Group is inadequately equipped and in need of additional support for field surveys. This is an especially pressing need since the National Soil Survey is scheduled to begin shortly and CARI should be participating.

The Meteorology Group has very little environmental monitoring equipment and needs to be able to develop weather stations at the locations where CARI is conducting research. Means must be provided to handle the volumes of data which these stations will generate so the information can be available in a timely manner to the research staff and the public.

It seems there is a shortage of transportation for the department. This needs to be remedied since much of the work carried on in Soil Survey and Soil Fertility involves sites away from CARI.

d. Status of Current Research

Since the department is staffed heavily by young scientists recently returned from study leaves, the research program is still developing. However, significant achievements are being made. Following is a list of some current research:

1) Soil Fertility and Chemistry

- Inherent fertility of Liberian Soils
- Nutrient requirements of cocoa seedlings
- Sorption capacity of Liberian soils
- Nitrogen requirement of Liberian rice varieties

2) Soil Microbiology

- Effects of fertilizer on the growth of azolla
- Survey of cassava varieties for mycorrhiza infection

3) Soil Survey

- Land feature and soil map of CARI
- Preparations for National Soil Survey (pending funding by EEC)

4) Agricultural Meterology

- The effects of planting date on growth, flowering and yield of various crops
- Meteorological data in the Suakoko area

5) Laboratory Studies

- Propagation of elite cassava and sweet potato varieties by tissue culture
- Testing cassava varieties for cyanide

The Land and Water Resources Department has already demonstrated its ability to identify research needs. With some assistance and direction it will be able to build on this base.

2. Direction of Future Research

While reasonable start has been made, considerable expansion of the research efforts should be considered in the future, especially in the following areas:

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a. The National Soil Survey should be a high priority item. Baseline data on land capability is essential.

b. Expansion of soil fertility and chemistry research should be encouraged. A quality calibration base for fertilizer recommendations is needed as Liberia shifts from its traditional slash/burn system to continuous cropping. This calibration data is needed for a number of crops, and under different soil and climatic conditions. Consequently this work needs to be done at locations throughout Liberia, and will require linkages with other organizations.

c. Efforts should be made to develop a National Weather record system and correlate weather data with crop yields and incidence of plant pests.

d. Two key areas which need attention are soil microbiology, and soil conservation and management. Again, as stable continuous cropping systems develop, the importance of soil microbiology will increase, particularly with reference to nitrogen fixation. Soil conservation through appropriate tillage and management systems will also become more important since many Liberian soils are extremely fragile, and prone to erosion and physical problems.

e A functional analytical laboratory is essential. It is needed to service the soil survey, soil fertility and soil microbiology work, and also for research in soil chemistry, as the need for new soil testing procedures develop. In addition, it is likely that the capability for soil physical measurements such as moisture retention, aggregation, bulk density, shear strengths, etc. will be required. The analytical laboratory is an integral part of this department and while it should serve a service function to other units of CARI, it should definitely remain in the Land and Water Resources Department.

3. Needed Inputs

a. Personnel

1) New Staff - The following positions should be established in the Land and Water Resources Department, and appropriate personnel recruited (in priority order):

- A soil conservation - soil management position at the M.S. level
- An instrument repair technician at the B.S. level
- An Agricultural Meteorologist/Climatologist at the M.S. level
- A Fertilizer Technologist at the M.S. level
- A second Soil Survey position at the M.S. level

2) Training - Additional training of existing staff should be considered in the following priority order:

- M.S. training in soil microbiology for Mr. Melville Harding
- Short-term, 4 to 8 months, training in Soil Survey and Soil Taxonomy for Mr. Peter Korvah
- Short-term, 4 to 8 months, training in environmental instrumentation for Mr. Flexchman Pedersen
- M.S. training in Soil Fertility/Plant Nutrition for Mr. Pofinema Gweama
- Ph.D. training in Soil Fertility for Mr. John Jallah
- Ph.D. training in Soil Classification and Genesis for Mr. Peter Korvah
- RDI and B.S. level training opportunities for junior staff who exhibit interest and aptitude

3) End of Project Staffing - At the completion of Phase II, the Land and Water Resources Department should have the following staff:

- Department Head, Soil Chemistry, Ph.D.
- Soil Fertility Specialist, Ph.D.
- Soil Fertility/Plant Nutrition, M.S.
- Soil Chemist, M.S.
- Fertilizer Technologist, M.S.
- Soil Conservation and Management, M.S.
- Soil Microbiologist, M.S.
- Ag-Meteorologist, M.S.
- Ag-Climatologist, M.S.
- Soil Survey, Ph.D.
- Soil Survey, M.S.
- Soil Analyst, B.S.
- Soil Analyst, B.S.
- Instrument Technician, B.S.

b. Facilities

Over the short-term, the new analytical laboratory should be completed and the existing facility made available for the soil survey and Ag-meteorology groups.

In the long run, the addition of a wing to the new laboratory to house these groups would foster communication and cooperation among Department members. Also greenhouse facilities are needed.

c. Advisors

Short and long-term advisors will benefit this department in view of the relative inexperience of the staff. Timing of the advisors is critical however to achieve maximum benefit. The following approach is suggested:

1) A short-term advisor to assist in the initial start-up of the analytical facility (4 P/Ms)

2) A long-term advisor, 24 months, to work with the soil fertility, soil chemistry and to a lesser extent, soil microbiology group. This advisor should arrive as soon as possible, to assist in the identification and imple- mentation of appropriate areas of research. (FY 85-86)

3) A long-term advisor to work with the soil microbiologist and the crop science legume/pulse program. This should be a term of 24 months, to immediately follow the return of both counterparts from study leave. The advisor could be housed either in this department, or crop science. (FY 88-89)

4) A Short-term TDY (3 months) for the long-term Soil Fertility/Chemistry Specialist to return one month each year following the long term assignment for consultation on advanced issues in the soil fertility research program (some specialist for both short-term and long-term).

5) A short-term advisor to assist in the installation of Weather Stations at CARI and Saye Dube and the training of operating personnel. Also to provide training in recalibration procedures for these Stations. (2 person months)

6) A short-term TDY (2 months) for the long-term Legume Production/Soil Microbiologist to consult with counterparts for one month prior to the long-term assignment on the design of the long-term research in these subject matter fields and for one month the year after the long-term assignment to consult on the advanced research problems in this research program. (some specialist for both short-term and long-term).

C. PLANT PROTECTION

1. Present Capabilities/Resources

a. Personnel

- Andrew F. Paye, M.S., Head, Currently Acting Director of CARI. Entomologist
- Hari Kulkarni, Ph.D. FAO Team Leader Pathologist
- Movlee Mends-Cole B.S., Entomology
- Alan Cobeh, (M.S.), Entomology, on study leave completing M.S.
- Vat ay Goba (M.S.) Pathologist on study leave completing M.S.

b. Facilities

Facilities available to the Plant Protection Department are less than adequate. Both office and laboratories are crowded, and in need of renovation. In addition no greenhouses or screenhouses are available for insect or pathology studies. This limits the effectiveness of the department.

c. Equipment

A considerable supply of good quality laboratory and field equipment appears to be available, furnished through FAO/UNDP. Light traps are being used for insect collection. Equipment for further epidemiology work and insect vector studies is needed.

d. Status of Current Research

- Resistance to broadmite in eggplant
- Chemical control of broadmite in eggplant

2. Direction of Future Research

- Surveys of insect and diseases of the principal food crops
- Cooperation with breeders in developing varieties resistant to insect and disease pests
- Integrated Pest Management
- Weed control
- Vertebrate pest control
- Cooperative efforts with animal science in animal pest control

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3. Needed Inputs - For the Plant Protection Department to grow and become an effective research unit the following inputs should be considered:

a. Personnel and Training

1) New Staff - The following new staff positions should be created in priority order:

- A weed scientist, M.S. level, to work on weed control in rice and vegetables
- A plant pathologist to work on disease control in vegetable and fruit crops
- A vertebrate pest control specialist, M.S. level, to study control measures in birds and other vertebrate pests

2) Training - The following training should be considered for current staff:

- M.S. training for Mends-Cole in entomology
- Short term training in insect identification for Mr. Kparbar
- Ph.D. training for Mr. Paye in entomology

3) End of Project Staffing - At the end of Phase II, the Plant Protection Department should have the following staff:

- Entomologist, field crops
- Entomologist, tree and vegetable crops
- Survey Entomologist
- Plant Pathologist, field crops
- Plant Pathologist for vegetable and tree crops
- Weed Scientist
- Vertebrate Pest control specialist

b. Facilities

In the short term, renovation of the existing facilities should be considered, particularly to add better lighting, increased storage cupboard space and air-conditioning. In addition five, 10'x15' screen houses for isolation and insect rearing should be constructed, together with a potting shed for storage of soil, pots, etc., for use in these screen houses.

Two additional facilities needed for the use of Plant Protection and other department are the development of a photographic unit with copy stand and darkroom facility, and the construction of a pesticide storage facility.

Construction of a Plant Protection building with laboratory and office facilities for the entire department should be considered for the long term.

c. Equipment

Due to the involvement of FAO/UNDP in this department, and their continued input through 1986, no equipment needs are identified for this department.

d. Advisors

- Long term advisor in weed science to give guidance to weed scientist upon return from training (FY 90-91) (This advisor should also interact with Crop Science and Land and Water Resource)

- Short-term advisor in weed science to give guidance on weed control measures and preliminary research design prior to arrival of long term advisor late in Phase II (2 P/M) (preferably same person as in item 1)

- Short-term Plant Virologist (2 P/M) and Nematologist (2 P/M) to give guidance on research programs in their specialty plant pathology disciplines

D. ANIMAL SCIENCE DEPARTMENT

1. Capabilities and Resources

a. Personnel

- S. Ravindran, Head, DVM (66) Bangalore, India (GOL contract person)

- John D. Fannieh, Animal Breeder, DVM (73) MVM (77) U. Zagreb, Yugoslavia

- Vaoka Johns, Animal Husbandman, B.S. (77) U. Liberia Dipl., (82) Scotland

- Edward Smith, Senior Pasturist, B.S. (80) University of Liberia (on study leave)

- John M. Kaykay, Nutritionist, M.S. (81) Utah, Cert, Extn, Ed, (81) U. Wisconsin

- Emmanuel Ngaima, Senior Pasturist, B.S. (80) U. Liberia

- Daniel F. Turlah, Lab Supervisor Training in Japan and U.K.

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b. Animal Handling Facilities

There are modest, but adequate facilities to handle the small herd of N'Dama cattle present on the station. Pasture appears to be well managed and adequate. The cattle herd is healthy in appearance and in good flesh. The small ruminant pasture is also well managed. The handling facilities are rustic, and should be redesigned to facilitate research and maintenance operations such as weighing, dipping and drenching. The swine production unit consists of enclosed concrete pens. Air movement is adequate above the concrete (about 1 meter high) but appears to be inadequate in the pens themselves. The concrete pens have contributed to some serious foot problems in their Landrace breeding stock. There are no poultry or dairy facilities currently on the station. The feed mixing facilities are adequate for a small swine herd, but may prove to be a problem with the additional pigs representing 5 breeds of exotics requested through the Phase I project.

c. Equipment

Equipment for the department is marginal in terms of basic diagnostic equipment, and instrumentation. Feed processing equipment is limited but adequate.

d. Status of Research Work

Management practices employed at CARI on trypanotolerant animals have resulted in reduced stress on animals (both cattle and small ruminants) which has made production possible with minimal losses due to trypanosomiasis. If such practices can be applied to animals owned by small farmers the potential exists for increased livestock production in the country. The current work in documenting disease incidence and production parameters for livestock under improved management and foraging conditions is useful; however, research proposals lack clarity and good experimental design.

2. Direction of Future Research

The problems facing animal production in Liberia should be addressed by animal scientists and veterinarians working in conjunction with socio-economists. There are no available data on the production capabilities of indigenous Liberian livestock (cattle, sheep, goats, pigs). Without this data, it is difficult to identify and prioritize the biological constraints to increased production. Further, lack of economic data of production means that inputs into the system cannot be evaluated in terms of their projected output. Thus any technological recommendation (from CARI or any other source) to increase production is on very tenuous group in terms of increasing profit. Lastly, the socio-economic factors that need identification include the motives for raising livestock.

With species other than chicken, there may be motives other than simply profitability. Animals are used for traditional ceremonial feasts, as a form of readily available cash and as an indication of wealth. The farmer

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who has 5 goats may not want or need increased goat production, since the time invested in the care of the extra goats may take away from other, more profit oriented, activities. For these reasons, future research needs include field work to determine the production characteristics and socio-economic motives of the small herd animal producers of Liberia.

Future research in the Department of animal science should address the production characteristics of the native breeds of cattle, sheep, goat and swine. Research projects currently underway and/or proposed within the department are designed to measure production characteristics such as fertility, birth weights, weaning weights, death rates, etc., in the cattle, sheep swine and goats at CARI. These animals, however are closely and well managed and thus will give a good indication of the production potential (under conditions such as at CARI) for each species. But information concerning productivity of animals as they are currently managed by farmers in Liberia is not available nor is it being studied. This is a serious constraint not only for the producer himself, but also for researchers who lack data which might suggest areas for further applied studies.

This research should include data collection on the reason(s) for disposal of animals from the herds and flocks. Whether animals are used ceremonially, sold for profit, or kept for breeding purposed, needs to be determined and the motives and goals of Liberian animal agriculture can then be assessed by animal and veterinary scientists as well as by socio-economists.

It is therefore proposed that Phase II include provisions for the collection and analysis of the following production characteristics for each of the following species:

CATTLE	SWINE	SHEEP	GOATS
Cows calving/ total cows	Sow farrowing/ sow bred	Ewes lambing/ total ewes	Does kidding/ total does
Calving interval	Farrowing interval	Lambing interval	Kidding interval
Date of calving	Date of farrowing	Date of lambing	Date of kidding
Sex of calves	Sex of pigs	Sex of lambs	Sex of kids
Mortality	Mortality	Mortality	Mortality
Date of death	Date of death	Date of death	Date of death
Disposal	Disposal	Disposal	Disposal
Number of bulls	Number of boars	Number of rams	Number of bucks

Through interviews and by observation determine:

- How are animals selected for breeding?
- How are animals disposed of?
  - Sale?
  - Home Consumption?

Currently there is a clear lack of data regarding the losses due to animal diseases on small farms. Research should be directed toward the following areas:

- Defining the nature and occurrence of disease in domestic animals through a systematic study of selected small farms.

- Studying the effects of changes in small farmer oriented production and management practices reducing measurable losses from diseases identified in (1) above. (Including deaths, animals requiring treatment, delayed maturity and decreases in reproductive performance).

- Studying the effect of changes in production systems on the ability of small farmers to produce livestock (i.e. improved pastures is unrestricted grazing; confinement raising of swine and poultry).

- Studying the potential for N'Dama cattle as traction animals for small farmers under conditions that manage for control of trypanosomiasis.

The goal of the proposed research on animal productivity is to determine the motives and problems of the animal producer, fit them into his production system and capabilities, and finally identify the constraints in the system. Once these factors are understood, research can be geared to resolve the major constraints limiting production on a step-by-step, project-by-project basis.

The study of production characteristic in the field will also serve as an extension opportunity, where farmers may receive advice from the visiting researcher and whereby the researchers are confronted with the problems facing the producer.

Thus, in a stepwise fashion, the proposed research will first determine the socio-economic basis for livestock production, the productive capabilities of native livestock and then on this basis research can be designed and implemented to overcome major production constraints.

This field survey and study should be completed prior to the end of year two of the project by an interdisciplinary team of socio-economists and livestock health and production specialists

3. <u>Needed Inputs</u>

a. Personnel and Training

- A PhD in animal science with a major in nutrition and a strong background in genetics

- One M.S. Animal Scientist - cattle
- One M.S. Animal Scientist-small ruminants
- One M.S. Animal Scientist-Swine
- One DVM Veterinarian-parasitologist or microbiology dual major

b. Facilities

Requirements for facilities, offices and laboratories will be met by the construction of a new laboratory to house a Veterinary science and Microbiology laboratory. This is supported by Phase I of the project. Upon completion, the present site of this laboratory will be converted into an animal nutrition laboratory, with facilities and equipment for a complete proximate analysis of feed stuffs. The laboratory equipment for the proximate analysis has been purchased through a grant of the FAO. The animal nutrition laboratory furnishes a resource not only to the animal nutrition researchers, but also to other CARI units such as inland fisheries and crop sciences. There is a need for improved facilities for the swine heard and the small ruminant flocks.

c. Equipment

Additional equipment is needed for diagnostic techniques including bacterial and viral isolation. Veterinary instruments and supplies are needed to complete research and to provide for the health of research animals. Foreign pharmaceutical companies often refuse to ship limited amounts of drugs thus making treatment of research animals difficult. Provision must be made so that orders can be filled when this occurs. Supplies for identification of animals are essential for meaningful research.

d. Advisors

Short term - 3 months

- Veterinary Microbiologist (1 person month)- to set up microbiology laboratory and train technicians (Note - supplies must be shipped in advance of the Advisor)
- Parasitologist - Entomologist (2 person month) to study tsetse fly populations and hemaprotozoa during October to January or April to June.
- Animal Nutritionist (1 person month) with experience in proximate analysis to set up laboratories and train technicians

Long Term

Animal Science/Nutrition (2 years), FY 91-92 - upon the return of Liberian PhD., in nutrition - breeding and genetics. The timing of this specialist would be preferred to be moved forward several years if the Liberian PhD. trainee could be scheduled for training earlier. Initiation of research in animal science is required earlier in the project.

E. INLAND FISHERIES DEPARTMENT

1. Capabilities/Resources

- a. Personnel

- John M. Jallah, Head, M.S. ('61) USSR. Study leave in Nigeria. Will return in 1984.

- Naomi Cassell, Research Assistant, B.S. ('80) Cuttington College. Study leave in Auburn. Will return in 1984.

b. Facilities

Existing ponds are in need of renovation. Due to lack of water in the dry season, however, it is recommended these be used only during the rainy season, and then only to serve as brood ponds for fish to stock the research ponds (not yet constructed). There are no ponds presently available which could adequately serve the needs of research. The hatchery, laboratory and office building appear to be basically sound, but in some need of renovation. A small dam should be built in the stream adjacent to the laboratory to provide sufficient water. Currently, there is no pump to furnish water to this facility.

c. Equipment

Laboratory supplies, equipment and commodities are available in the fisheries department, including some water-testing kits. However for research (wet laboratory) it is obvious that additional equipment and commodities will need to be identified and purchased. An analytical laboratory within CARI could support the more sophisticated analyses requirements that will develop within the fisheries unit during Phase II.

d. Status of Research Work

Currently the Fisheries Department has the role of producing fish for stocking the ponds of area farmers. Although various species of fish are produced, tilapia is the species being most heavily utilized for this purpose. To date, no research has been performed, yet there are many questions which need to be studied.

2. Direction of Future Research

Fish production shows many signs of being a profitable enterprise for the Liberian farmer. Many fish have been distributed through the CARI program and farmer interest appears high. Yet, there are many unanswered questions that need research attention before one can recommend a practice with any assurance that it will improve the welfare of the farmer. Controlled studies at CARI and field studies at various sites where fish have been distributed should be utilized to determine the potential production of fish per acre of pond under various management regimes. Labor and other inputs required for simple pond construction should be determined. Production potential of various fish species need to be quantified. Appropriate pond and fish management practices need to be determined through adaptive research. Methods of incorporating fish into the diet require attention. Questions such as water quality, fertilization materials and procedures, stocking rates and growth curves are needed to properly care for the fish. In particular, low-input solutions to these problems should be sought.

Finally, fish production needs to be evaluated in terms of its overall contribution to the socio-economic welfare of the small Liberian farmer. The present approach of CARI, that of providing fish for stocking farm ponds, is fraught with the possibility of failure. Without a minimal amount of data to indicate the potential of fish production in Liberia, the possibilities of failure are too high upon which to risk the credibility of a developing institution such as CARI. It is therefore recommended that CARI begin a field research program in aquaculture which includes data collection on the production of fish by farmers, their attitudes toward fish production, and the markets they utilize to commercialize their product. Simultaneously, efforts should begin at CARI to study production characteristics of various species, (including their marketability) correct water quality management, stocking rates and pond production.

Armed with the socio-economic information gained from field observations and necessary technological information gained through adaptive research, it seems likely that a successful fish culture program could be established in Liberia, and that CARI could play an important role in its development.

3. Needed Inputs

a. Personnel and Training

1) One Ph.D. level training grant is needed in the area of fish production and management. The training should provide the knowledge and ability required to participate in and manage the fisheries research team at CARI.

2) Two M.S. level training grants in the area of fish nutrition and fish pond management.

b. Facilities

The presently available ponds are inadequate for fisheries research. They were built over 25 years ago and have since deteriorated. This area will need to be renovated to serve as brood ponds for fish to stock the research ponds. It is recommended that a short-term (3-month) consultant be hired to assist in the design of the proposed fish research ponds, water supplies to the research ponds and hatchery, and in the planning of the fisheries research laboratory. An area has been identified to construct the research ponds. This area apparently has available water throughout the year. Phase II should support CARI in the design and construction of these facilities, thereby creating a means to provide the research information needed to make fish production a viable alternative crop for the Liberian farmer.

c. Equipment

There are needs for equipment such as pumps, nets, microscopes, vehicles and chemical and laboratory equipment.

A list of equipment needed was developed for the design team. It is recommended that this list be modified during the visit of the first short-term Consultant of Phase II (see below).

d. Advisors

1) Short-term (2 months) fish culture specialist. This consultant should be experienced in the design of research facilities (ponds, water supply, hatchery and laboratory).

2) Short-term (3 months) fish culture research specialist. This consultant will assist in the interpretation of field research data to be collected before his/her arrival. From the field study results, a research program will be developed with the delineation of the goals and objectives of the research effort of the Fisheries Department of CARI.

F. AGRICULTURAL ENGINEERING AND APPROPRIATE TECHNOLOGY

1. Capabilities and Resources

Agriculture engineering is a relatively new function of CARI, though activities have been going on for a number of years. At present two distinct programs are underway, a Post Harvest Rice Technology Program headed by Dr. Rama Rao Vellanki of FAO in the Crop Science Department and an Ag-mechanization or Appropriate Technology program that was headed by Mr. Norman Illsley of the LSU Team.

a. Personnel

- Dr. R. Rama Rao Vellanki, FAO Post Harvest Technologist scheduled to depart in July 1984.

- Mr. David Kenkpen, Post Harvest Technologist on study leave in the Sudan.

- Mr. Winston Bedell, Ag-mechanization student recently returned from study leave in the United States.

b. Facilities

Available facilities are inadequate. The Post Harvest research group has a laboratory in the Crop Science Department which appears functional but needs upgrading. However, no space has been provided for the Ag-mechanization, Appropriate Technology Advisor, who has been forced to work in the maintenance area and in his home.

Adequate shop facilities are also lacking. Fortunately some private shop facilities and heavy equipment are available in Bong County and have been used. This constraint should be remedied in the immediate future if the program is to be functional.

c. Equipment

For an Agricultural Engineering unit to function properly it must have access to adequate equipment and tools for the manufacture, design and modification of agricultural machines. In the case of appropriate technology for a developing country this would include equipment for metal working and simple metal foundry work, wood working and masonry, rather sophisticated equipment that might appear unnecessary for the construction of these machines. However, in the initial design and modification phases, tools such as lathes, milling machines and welding and brazing equipment is extremely important. Unfortunately little of this equipment is available at CARI.

Another important component of an appropriate technology unit is a ready supply of construction materials and commodities. This includes lumber, hardware, steel pipe, steel plate, etc. from which machines can be fabricated. Since one objective is to design equipment which can be fabricated by local artisans, the Department should have the authority to search out, and procure locally available materials. This flexibility is vital to the function of the unit.

d. Status of Current Research

Valuable work, both in research and research support, has been done in Ag-engineering. Some examples are:

1) Post Harvest

- The development of a simple threshing frame to decrease threshing loss and improve the quality of threshed rice.

- The development of simple parboiling equipment to improve rice milling quality at the farm or village level.

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- Testing of domestic bins and rat guards as a means to reduce storage losses of rice.

- Field studies to determine the losses in farmers fields during rice harvest, threshing and storage operations.

2) Ag-Mechanization-Appropriate Technology

- Development of a simple irrigation gate that can be fabricated locally.

- Development of tools for village-levels shops which can be built with local materials. A grinding machine has been built and the design picked up for local manufacture.

3) Research Support

- In addition to developing appropriate machines, the Ag-mechanization program is working closely in interdisciplinary research. Examples could be cited of support through equipment repair or modification in every department in CARI.

- Both the Post Harvest and Appropriate Technology projects are providing equipment which can be used by the small Liberian farmer. This is especially impressive considering the constraints under which they operate.

2. Direction of Future Research

Both the Post Harvest and Ag-mechanization projects appear to be working in appropriate areas. Unfortunately they are directed by expatriates who will be leaving CARI shortly. Hopefully work can be continued in the same basic areas when the Liberians on study leave return.

Proposals to expand Post Harvest research to additional crops have been made and this is desirable. It is especially true in those areas which relate to improved quality and marketability of such cash crops as oil palm, coffee and cocoa and to enhance the use of crops such as cassava or its by-products for animal feed.

One major missing component of Ag-engineering is the area of Soil and Water Mechanics. With emphasis being placed on swamp development for rice and vegetables, and on the development of inland fisheries, this is an extremely important area. The identification of suitably trained or trainable Liberians to begin work in this specialty is essential.

In the future an Agricultural Engineering Department composed of the following three research service areas is recommended:

- Post Harvest Technology
- Soil and Water Mechanics
- Appropriate Agricultural Mechanization and Research Support

One way to develop Agricultural Engineering is:

- Transfer the Post Harvest group to Agricultural Engineering.
- Utilize the Liberians currently on study leave in Post Harvest and Agricultural Mechanization as counterparts for an expatriate advisor or contract employee.
- Identify an appropriate Liberian for training in Soil and Water Mechanics.

3. Needed Inputs

a. Personnel and Training

The following key individuals need to be identified as the potential core of the Ag-engineering Appropriate Technology Department:

- A process Engineer to work in Post Harvest Technology. This individual should receive at minimum a B.S. level training in the first five years of Phasse II. In the second five year period he should receive an M.S.
- A Soil and Water Mechanics specialist for swamp development. This individual should also receive B.S. level training in the first five years and an M.S. in the next five years.
- An Ag-mechanization specialist to coordinate the Appropriate Technology-Research support laboratory and develop appropriate agricultural mechanics. This person should have at least a B.S. level training.
- A laboratory supervisor for the Appropriate Technology - Research Support Laboratory. This person should have a minimum A.A. Degree.
- A skilled craftsman in the areas of welding, machine tools, foundry, wood working and metal working.

Some of these individuals may exist among the current junior staff and Liberian staff on study leave. However, every effort must be made to identify all individuals and initiate training within the first 18 months

of Phase II. Since Liberia has no institution to train Ag-engineers at this time, the three B.S./M.S. level people should be allowed to complete a B.S. degree in an appropriate foreign institution.

The Laboratory Supervisor should also receive specific training at an institute such as IITA in the early stages of the project. Later it may be desirable to allow this individual to pursue an appropriate B.S. degree.

b. Facilities

In the first year of the project, renovation of the rice mill to provide an interim laboratory should be completed. In addition, general upgrading of Post Harvest facilities is needed.

In the longer run a new facility should be designed and constructed to consolidate the department into one unit to improve communication and cooperation.

c. Equipment

Basic mechanics tools, metal working tools, welding and brazing equipment should be purchased immediately to furnish the renovated building. Upon completing a new building, additional equipment will be needed.

d. Advisors

Advisors, both short and long-term, will be most useful in developing the capabilities of the Ag-engineering/Appropriate Technology Department to function as a Research and Extension Unit.

Timing of advisors is critical. Short-term advisors should be used initially to assist in the renovation of existing facilities and develop them into useful laboratories. This includes developing appropriate equipment lists for purchase through Phase II. A Long-term advisor would arrive to coincide with the return of Liberians from study leave to assist them in developing appropriate research programs.

1) Long-Term

- A 24-month term for an Agricultural Mechanization specialist to work with the returning Liberians in Ag-mechanization and Post Harvest Technology (FY 87-88)

2) Short-Term

- A 3-month TDY to assist in the design and renovation of facilities and the installation of equipment

- A 2-month TDY to assist in the design of the new Ag-engineering building

- A 2-month TDY to assist in the design and implementation of water management systems for development of swamp areas for rice production

- A 5-month TDY to assist in the modification of or new design of animal traction and other mechanization equipment

G. SOCIO-ECONOMICS

1. Capabilities/Resources

Under the present organizational structure of CARI the Socio-Economic Officer reports to the Director of the Institute. His position is comparable to that of the Research Coordinator, the Administrative Officer and the Extension Liaison Officer. He has functioned as an Advisor to the Administrative Officer. Under guidance from the Director he was to translate agricultural research into a form useable by other sectors of the economy and to assess potential socio-economic impacts of research conducted at the Institute.

The expatriate who filled this position has devoted time to assisting and advising the CARI Research Coordinator and the Administrative Officer. He Has developed information on the agricultural situation in Liberia in order to identify research needs.

From January 1982 until near the end of 1983, the expatriate Agricultural Economist functioned without a Liberian counterpart. A Liberian Socio-Economic Officer with a Master of Public Administration degree has since joined the CARI staff.

Field trials for two of six alternatives for Continuous cropping were carried out in 1983. This work may be considered as agronomic in nature. In order for it to be scientifically sound, cooperation is required between crop scientists, appropriate technologists and the agricultural economists. Because of lack of cooperation (for various reasons) the agricultural economist carried out the research pretty much on his own. Only one year's results are available and there was a lack of closely controlled conditions during the first year. This research is not an appropriate function for this department. The Development of technology for continuous cropping will be performed in the future by an interdisciplinary task force appointed by the Director of CARI.

a. Personnel - Arthur S. Gedeo MPA (78) Syracuse University

b. Facilities - none

c) Equipment - none

d) Status of current Research

Research performed to date has not addressed socio-economic issues at the producer level. In sharp contrast, the senior expatriate Socio-

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Economics Officer has conceptualized a series of agronomic experiments as potential alternatives to the traditional slash-and-burn system for upland rice cultivation in Liberia. The current system produces either one or two crops of rice or one crop of rice followed by cassava after which time the land reverts to fallow. This traditional system of slash and burn cultivation has worked over a long period of time as a means for retaining soil fertility, and reducing erosion. In an effort to increase labor productivity, various alternatives have been proposed.

2. Direction of Future Research

The newly created socio-economics department should perform three functions for the institute. It should assist the Director of CARI and the Research Coordinator in evaluating research projects, should conduct micro economic Analysis of Farming Systems and, should conduct socio-economic surveys of areas where farm trials are scheduled to be conducted by the Economic Liaison Office and National Extension service.

A Socio-Economic Department will be established as proposed in the recent project evaluation and the duties of the Socio Economics officer will be revised.

The Socio-Economic Officer will assist a multi-disciplinary research evaluation team headed by the Director of CARI and assisted by the Research Coordinator to evaluate the economic significance of each proposed research project, its technical feasibility, the appropriateness of the research design, cost of project and potential payoff.

A major activity of the Socio-Economics department will be to conduct research on its own. Initially, two major activities are anticipated: (1) farm level surveys of farming conditions in Liberia and (2) micro economic analysis of farm activities.

The purpose of the farm level surveys would be to document the situation in which farm production and household activity occurs. Much information currently exists in the minds of agricultural specialists in Liberia but little documentation is currently available. The surveys would be designed to collect information on size of farm, labor and other resources availabilities, current cropping patterns, attitudes toward risk and the ability to bear risk, current household consumption patterns, and farmers goals and objectives. Information on goals and objectives should be useful in understanding why farmers keep some enterprises and not others, why they may produce only for home consumption and may or may not be interested in producing for market. These data should be useful in understanding the economic and social reasons for certain practices and should facilitate the design of new technology so it will be acceptable.

The socio-economic survey team should be interdisciplinary. In the initial design phase, the team should consist of the Agricultural Economist as team leader and be assisted by crop and animal scientists and a rural sociologist (or anthropologist). This team would jointly design the survey form. Furthermore, the entire interdisciplinary team should be involved in

field testing of the survey form. In the conduct of field surveys, interview teams should consist of at least one social scientist, one physical subject matter specialist and one MOA field extension agent of the area. This field agent should be fluent in the local language and should be technically qualified in either crop or livestock production technology.

After a socio-economic survey has been conducted in an area selected jointly by the Director of CARI, the County Agricultural Officer and the Director of the Agricultural Development Project (if one exists in that County), the Socio-Economics Department will identify farmer candidates in selected villages to implement on-farm trails. The implementation of the on farm trials will be conducted by the field level extension officers (MOA and/or ADP) under the leadership of the (CARI) Extension Liaison office and the concerned MOA Subject matter Specialists. If the field trials verify the feasibility of the technology to the agro-climatic and farmer's resource conditions and the farmer decides to adopt the practice, a result demonstration of the improved technology will be conducted on the same farm the following year under the management of the farmer with technical guidance by the same MOA extension staff.

The MOA should designate a minimum of eight qualified extension field agents in each county to be trained by the socio-economics department in survey objectives and techniques and to participate on continuing basis in conducting socio-economic surveys in their respective counties.

Micro economic analysis is the other research major activity to be undertaken by the newly created Socio-Economic Department. Analysis should be conducted in a logical progression toward being able to evaluate new technology when it is introduced into a production system. This would require development of enterprise costs and returns at the farm level. Some of this kind of work has been done at the MOA level and is done by the ADP's. However, this needs to be done at CARI with a more comprehensive orientation. The ADP's only collect data from their cooperators which limits the applicability of their results. The MOA has often used a case study approach. Both approaches, while useful, limit the applicability of results. Development of enterprise costs and returns and other technical coefficient data is needed.

Whole farm analysis should proceed using two approaches. Relatively simple partial budgets followed by whole farm budgets can be constructed once costs and returns data are available. More complex enterprise combinations and household activities can be analyzed with linear programming. This approach can be pursued after the proposed micro computers are in place, staff is trained in enterprise analysis and coefficients are available from the surveys.

Development of the whole farm analysis approach will then permit evaluation of new technology as it becomes available from the crops and livestock divisions. Such analyses facilitate the identification of economic opportunities and are highly useful in identifying constraints to the adoption of new technology. Also, this approach can be used to analyze the effects of multiple objectives pursued by farm families and can incorporate social as well as economic constraints into the model.

Development of the costs and returns information and enterprise budgets can contribute to the development of a farm management manual for Liberian conditions and should be useful to extension agents and leading farmers. The microanalyses should also provide a basis for development of relatively simple recommendations to farmers.

Work of the type described above should be complementary to the economics work of the MOA. The ADP's Work at the MOA has been concentrated more at the agricultural sector level and its relationship with the rest of the economy. That work would be on a more solid footing if it is based on sound micro level analysis. Given CARI's location and missions it is logical for CARI to concentrate on the micro level analysis. The proposed work is also complementary to the monitoring and evaluation work of the ADP's. Their farm analyses concentrate more on information from cooperating farmers and on data to evaluate program performance. Such an approach leaves a gap in understanding parts of the farm sectors which would be covered by the proposed work.

3. Needed Inputs

a. Personnel and Training

1) New Staff

- 4 Agricultural Economists-BS
- 1 Rural Sociologist-BS
- 3 Technicians-RDI (Data Collecting/Processing)

If it is possible to hire two persons with M.S. degrees in agricultural economics this would provide an initial staff of three persons in the Department with M.S. degrees. It has been suggested that there may be as many as six or seven persons in the country with suitable training from which to select two to come to CARI. Hiring in at this level would greatly facilitate the field survey work which was proposed above. If it is necessary to hire persons with only the B.S. degree, they should be sent for M.S. level training with one being sent as soon as he has become oriented to the work at CARI and the other as soon as the first one returns. Some work at CARI before going for graduate work would seem to be highly desirable in order to better understand the links between CARI research and the need for graduate training.

2) Training

- PhD. in Agricultural Economics for Mr. Arthur Gedgo
- M.S in Agricultural Economics for Two B.S Agricultural Economists
- M.S. in Rural Sociology for B.S. Rural Sociologist

3) End of Project Staffing

- Agricultural Economist, Ph.D., Head
- Agricultural Economists, M.S. degree
- Rural Sociologist, M.S. degree
- Agricultural Economists, B.S. degree
- Technicians - Data Collection/Processing

b. Equipment

The principal equipment needs would include a micro computer for storage of survey data and statistical analysis of survey data and field research data. In addition, each staff member and technician should be provided with a desk calculator and a small pocket calculator.

Equipment for carrying out crops and livestock work is assumed to be available from the respective departments as they become a part of the team carrying out farming systems research. Field equipment would be the responsibility of the appropriate technology offices. Needs would be determined by the farming systems team and the short term advisor listed below.

Two vehicles would be needed for the department, one for use by the Expatriate and the other for use by his counterpart. Ten motorbikes would be needed for the major survey work. They would also be used in subsequent survey work which is anticipated as a part of the micro-economic studies.

Office space with desks and filing cabinets will be needed for the proposed department. When the office is fully staffed, desks will be needed for the 6 professional staff plus space for the expatriate advisors. A work space will be needed for statistical work to be done by the technicians. Space will also be required at each of the MOA County Agricultural officer ORADP's for the county surveyors and for occasional use by CARI socio-economic team Members.

c. Advisors

Since a major expansion in socio-economic work is planned it will be necessary to have a long term advisor in the area of farm management at CARI for most of Phase II. During the last half of Phase II it is anticipated sufficient progress will have been made in farm management that a marketing specialist should be added.

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d. Technical Assistance

1) Long Term

- Agricultural Economist (7 years, FY 85-91) to provide guidance to the CARI Socio-Economics Department Chairman in conducting FSR/E surveys and in economic analysis of performance of improved technology packages and the impact of their adoption on farm household budgets.

- Rural Sociologist (3 years, FY 85-87) to provide guidance to CARI the Socio-Economics Department chairman in the social value considerations in conducting FSR/E surveys and in evaluating the social value impact of improved technical packages on farm family households.

2) Short Term

- Agricultural Economist marketing (5 months) to provide guidance to the CARI Socio- Economics Department on techniques for market surveys and analysis.

- Rural Socilogist (2 months), same person as long term Rural Sociologist, to provide follow up guidance one month each year on more complex issues involved in development.

H. LIBRARY

1. Capabilities/Resources

a. Personnel

The most serious impediment to development of the CARI library is the lack of a qualified full-time librarian. It is unlikely that a Librarian with a graduate degree in library science could be located, so someone should be sent for training.

In the meantime, the existing arrangement using Cuttington College's librarian should be continued. The CUC librarian will need more help from CARI research staff as he takes over the acquisitions work, as he has not previously had to deal with technical literature in agriculture and is not familiar with the areas in which CARI is doing research. The Library Committee should be reconstituted to help him.

It is recommended that CARI's present library worker be supported for either a 2 or 4 year training in librarianship so that she can give adequate support as assistant librarian. The possibility should should be explored of getting a Peace Corps Volunteer, preferably a qualified librarian, to help out while CARI library staff members are in training.

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b. Facilities

The CARI library should be a collection of basic textbooks, abstracting journals that cover tropical agriculture in each of the disciplines in which staff members are working, a small number of periodicals (10-15), and an extensive collection of non-book materials. The latter would include publications of the CGIAR institutions and other international agricultural centers.

There are at least two good mechanisms for getting photocopies of articles for which abstracts are seen: (1) The contracting university should provide back-up for the CARI library to the extent that CARI can send lists of references that staff members have requested and the university can get photocopies back to CARI within less than a month. (2) USAID has a librarian (Mr. Harry Dewey) permanently stationed at the National Agricultural Library, Beltsville, whose mandate includes the provision of photocopies and also computer searches to satisfy the needs of overseas technicians. Both of these services have been utilized over the past two years. The contracting university should be asked to supply copies of articles from commonly held journals and NAL should be asked for copies of "exotic" publications.

2. Needed Inputs

a. Advisors

A short term consultant should come out from the agriculture library of the university that gets the contract for Phase II. He/she would make recommendations for the future development of the library (both facilities and library holdings). This person would work with Mr. Nyamadi to determine what additional literature resources should be given priority for procurement, including bibliographic searches, and would be expected to give backstopping in the future, including photocopy service, soliciting of lists of recommended books in various disciplines from the contracting university's heads of departments, and sending CARI excess copies of publications.

b. Facilities

Expansion of the present library. The area occupied by the present library, is 450 square feet. About two and a half times that area is needed, with a separate work room and storage space. The Analytical Laboratory which occupies rooms adjacent to the library is slated to move to a new building now under construction. Conversion of room and the small balance room next to it into an extension of the library would go a long way toward meeting the needs of the library during the next few years.

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c. Major Equipment and Supplies - the following would be needed:

- additional air conditioners
- 10 Standard size carrels
- 5 six foot tables with appropriate chairs
- 1 vertical file cabinet
- 1 microfilm reader
- 1 microfiche reader
- 1 microfiche storage cabinet
- 1 photocopier
- Equipment for storing slides and perhaps other audiovisual materials (if these are to be kept in the library).

d. Library Materials

It is requested that 300-500 books should be purchased per year for the first three years and 200 books per year thereafter up to the end of the ten year period. Subscriptions should be placed for 20-30 scientific and abstracting journals to be selected by the library Committee.

NUTRITIONAL CONSIDERATIONS FOR AGRICULTURAL RESEARCH

I. INTRODUCTION AND BACKGROUND INFORMATION

The most important food crop in Liberia is upland rice. Ninety percent of the land will support cultivation of rice and other food crops, but only 35% of the total area is at present under cultivation due to the labor demands of shifting cultivation. The slash and burn method allows a field to be planted in rice only one or two years, followed by one year of cassava, and then 5 years of fallow. The average yield per household growing rice is 1070 lbs/acre (Table 1). The low yields reflect the level of technology. The average yield is less than one half the world average which is 2200 lbs/acre and one-fourth the average yield in the United States (4500 lbs/acre).

II. IDENTIFICATION OF TARGET GROUPS AND AREAS: Defining the Problem

The most comprehensive national nutrition survey in Liberia was carried out from December 1975 to March 1976 by the Ministry of Health and Social Welfare with the Assistance of the nutrition assessment unit of the School of Public Health at UCLA in cooperation with USAID. The following results and discussions are based on that study.

A. Nutritional Status of Children

From the following table based on ecological area, the prevalence of chronic protein-calorie malnutrition (PCM) defined as less than 90% of expected height-for-age, in agricultural areas is 15.6% or almost 3 times that of non-agricultural areas in the age group 6-11 months.

There is relatively little difference at the 2-5 months age group demonstrating the adequate nutrition provided by breast feeding throughout the country.

From Table 3, there is no acute PCM in any important prevalence percentage results by age group or by area. This contrasts with the much higher prevalence of chronic PCM.

From Table 4, children in all areas had the highest prevalence for low weight for age from 6-23 months, (the transitional time period when children are weaned from the breast to the family pot). Large differences again occurred between agricultural and other areas. Semi-remote areas had the highest prevalence for underweight (41.1%) at the age 6-23 months.

B. Agricultural Areas

Bong, Montserrado, and Grand Bassa together have children with a lower prevalence than the rest of the country, of chronic PCM based on underweight, arm wasting and fat wasting. PCM appears less of a problem in these counties, at least concerning agricultural areas. From Table 5, the major contribution to these differences comes from Bong and Montserrado Counties.

Bong County alone had the lowest prevalence of chronic PCM and underweight for all agricultural areas of Liberia.

Coastal counties apart from Montserrado have a slightly higher prevalence than inland counties of chronic PCM, (23.5% vs. 20.7%), underweight children (28.6% vs. 25.9%), and arm wasting (15.0% vs. 12.9%). The magnitude of these differences is not significant.

The extent of acute PCM (low weight-for-height) is small throughout all counties.

C. Maternal Nutritional Status

Table 6 shows that approximately 10% of all mothers in the Liberia sample had low stature, 5% had arm wasting as defined by low arm circumference and 20% fat wasting according to low fat fold (measure of caloric reserve). Pregnant women had a greater prevalence of low fat fold than non-pregnant and a lesser prevalence of low height.

With county groupings low fat fold prevalence was far less in Bong and Montserrado than the rest of the country. No other significant differences were found. It should be noted that these two counties had the lowest prevalence of child PCM than the rest of the country.

D. Tribal Rank of Mother

The Spearman rank correlation test showed a significant agreement for tribe ranking of mother and children regarding prevalence of low height and low height/age. This suggests that there may be a genetic factor in determining child stature. It should be noted that if the mother was stunted as a child, perhaps due to an unfavorable nutritional environment, this may result in her eventual short stature. (Table 7)

E. Anemia

There was a very high prevalence of anemia, as shown by low hemoglobin levels (Table 8). These results were expected due to known problems of malaria, hookworm infestation and poor diet. On the other hand, the prevalence of severe anemia demanding urgent clinical attention (hemoglobin below 6 gm/100 ml) was only 1.1%. (Table 9)

III. FARMING SYSTEM AND NUTRITIONAL CONSIDERATION

A. Population Pressure

Where population density is over 100 persons per square mile, the farmers are more prone to move to swamp agriculture. Thus, it is in the Kissi Clans of Romboli and Tengia with population densities of 120.3 and 133.1 respectively that one finds extensive swamp rice practices.

Another factor to be considered due to growing pressure upon the land is the increasing use of upland areas for tree crops. Having planted these lands with coffee and cocoa, they no longer remain available for upland rice farming.

The population is growing at about 3% per annum, farm households in this area consist of about 10 individuals and the average, household, upland rice farm consists of about 2.2 acres.

If the fallow period for the area is 7 years, the household will have to have a minimum of 17.6 acres to continue to produce sufficient rice to feed the household. There is not enough land to maintain the above ratio. The result will be that farmers will either move to the swamp area or decrease population by out-migration. Swamp rice agriculture could put more demand on women's work and possibly, adversely affect their caloric body stores.

B. Swamp Rice Agriculture

Extension introduction of swamp rice traditionally has been a "women's crop" of secondary importance and often grown for sale rather than consumption. Thus, it has often been women who have taken the initiative in adopting improved swamp rice. Likewise, the World Bank has concluded that return to labor for tree crops is considerably greater than for rice. Yet, for cultural reasons Liberian farmers' first priority remains meeting the household requirement for rice rather than maximizing income.

Intensive swamp rice technology is most likely to be accepted in those areas of Liberia where there is a land constraint (for whatever reason) and where there are family males to clear vegetation from the swamps. In the absence of these conditions, the new technology does not "make sense" to Liberian women.

From the accompanying figure, the months of July, August and September represent the "hungry season" when rice stocks are low and cassava plays an important role as a substitute energy source. This season also coincides with peak labor demand for women. One can speculate that time allocated for lactation diminishes, a high rate of spontaneous abortions occur and low birth weight infants are born. A woman's energy consumption required to meet her energy needs of: 1) maintenance,

2) reproduction, 3) lactation and 4) work to maintain energy balance would be so great that she would have to cut back on either physical activity or physiological functioning. Since it is the "hungry season" compensation is being made. Whatever adjustment is made, it is most likely the nursing child or fetus that is being affected.

Rice is viewed as both a food bank and a cash bank. If the farmer has rice she has something to eat. If she has an unexpected expense, you can sell it. If there is surplus cash on hand, it is invested in rice so that the money is neither stolen nor squandered. Rice is both a subsistence and cash crop.

As CARI disseminates higher yielding rice varieties and farmer acceptance increases, the additional cash and rice available will provide a "cushion" for the farm family to either hire additional labor and ease the work burden of the women, or purchase additional protein, meat or fish.

C. Rice Production and Nutritional Status

The relationship (Table 10) between rice production and child nutritional status was investigated to compare food availability during the period just prior to the nutrition survey with nutritional status and comparing this correlation according to different areas of the country and different age groups measured.

The results were striking. There was a consistency of high correlations: The higher the rice production, the worse the nutritional status. One possible explanation is that early and inappropriate weaning practices were so negatively influential that additional food or income in the household made no difference. There seemed to be a cultural lack of understanding of appropriate weaning practices.

D. Cassava

Cassava cultivation is a secondary or co-staple with rice in Liberia. Women produce and control the allocation of cassava in Liberia. It is a women's crop. Cassava is most popular in Nimba. The amount grown by individual women is a function of available land and labor. Equally important to the root are the leaves of the cassava plant which are one of the most popular and nutritious greens in the Liberian diet.

There are two cropping patterns for cassava. Throughout the country it is intercropped with upland rice, the method most common in most areas. Or it can be planted in areas with poor soils not suited to rice or when planted by women who do not have access to the labor necessary to cultivate an upland rice farm.

The nutritional value is an important issue in whether a policy of encouraging the planting and consuming of more cassava is desirable. The substitution of cassava for rice has occurred where there is land or labor

constraints. In areas where a shift to cassava has occurred, an increased incidence of malnutrition in children has been reported. From a nutritional and agronomic point of view, it would be more advantageous for CARI to promote sweet potatoes to gradually replace cassava in the diet. As with cassava, both the green and the tuber of the sweet potato are consumed in the household.

E. Legumes

Another crop which is grown and controlled by women in some parts of the country is peanuts or groundnuts. Last year's rice field is often used. Although some of the peanuts may be used for home consumption, the bulk is for a market sale and may be the major source of cash income for some women. They are sold unprocessed and processed. Groundnuts would be ideal as a protein supplement for weaning food mixes at the village level. It has high acceptability and is palatable for children. It should be encouraged in CARI research projects.

F. Tree Crops

Most farmers still view cash cropping as a supplement to and not a substitute for subsistence oriented rice cultivation. Coffee and cocoa are attractive to farmers because they require little capital investment (Tables 11, 12). They can be cultivated using the same foods which are used in rice cultivations. The investment is one of labor and, perhaps, the purchase of seedlings. These do not compete directly with responsibilities in rice cultivation. Nor is any capital investment required for processing the produce for market. Tree crops may represent an inheritance to the next generation. They serve both long-term and short-term economic interests for rural households. On the one hand, they serve villagers long term interests by securing their claims to given plots of land, in contrast to those who prefer shifting cultivation of upland rice.

Oil palms are viewed by people in several areas as being a "good crop" because a continuous income throughout the year is provided in contrast to coffee and cocoa which are highly seasonal. But commercial oil palm cultivation appears feasible for small holder farmers only where there are commercial extracting facilities available. Both men and women sell palm oil, although there may be regional differences as to which sex is the major seller.

Farm households also have immediate short-term requirements for cash of sufficient importance that they will accept a low price from middlemen now rather than accept the full official price later.

The reason is an obligation to secret societies (Poro & Sande) which bear responsibility for the passage of children to adulthood. Secret societies are extremely important in Liberia and carry with them high money costs to pay for the training.

As male migration increases, tree crops are a human attractive alternative for the woman farmer because of their low capital and labor investment. They are an energy-sparing system and counterbalance the high caloric expenditure needed for rice cultivations. CARI should investigate good crop/tree crop mixes among small landholders to find the best return on labor.

IV. CONSUMPTION

The provision of an adequate diet for all segments of the population: children, pregnant and lactating women, adult males, and the elderly, appears to be a function of proper utilization of local foods and not a function of availability.

Based on an analysis of consumption of 1976 data (Table 13) daily per capita consumption of caloric and protein in both the urban and rural areas met 100% of the FAO requirements. These data are not disaggregated by age or physiological state (pregnant, lactating) so that one cannot generalize that each household member is receiving his or her daily needs. However, from the aggregate sense, availability is sufficient. It is well known that infection compromises absorption and utilization of nutrients. From that standpoint prevalence of malnutrition is due more to health factors than agricultural ones.

In another study by the Bong County Agricultural Development Project on food consumption and cash expenditures in 1981, consumption of rice is the lowest during the months of July, August, and September when farmers experience scarcity of food supply and there is a relatively greater need for outside labor. In an average family size of 6.5, the total cash expense was about $31.00 for all food items (Table 14) with about 40% of the family budget going to rice and 25% for meat and palm oil. Fish contributed 14 % of cash outlay while 13 % went to kerosene and soap.

When farmers require Kuu labor (communal) in contrast to hired labor for planting, they must purchase food for the workers. The farmers need $40 - $50 during the critical months of July - September (Table 15). If they fail to provide for their labor and their planting is delayed, then they will suffer losses in their rice yields. It is important to note the realization that Kuu labor's productivity in the rice field will be directly affected by the nutritional input as provided by the farmer. Cash expenditures for food in Bong by these farmers represent an indirect indicator as to the nutritional well-being of the Kuu labor force.

A. Consumption Effects Linked to Income and Prices

The elasticity matrices found in Table 16 were based on data collected in 1976-1978. Although the data may be out-dated the basic underlying structure of food demand changes slowly. Therefore the direction of changes from the table will most likely be correct and applicable to Liberia today than the actual magnitude of the changes.

The analysis of data from another country (Sr. Lanka) suggests that both prices and income elasticities for staple foods increase from the very poor to those with moderate income levels, and then decreases as income levels continue to rise. If this trend is similar in Liberia, then the estimated price elasticities are probably correct.

One of the assumptions in this analysis is that everything else is held constant when looking at two relationships. The expenditure column is a reasonable proxy for income.

In the rural areas there is a high correlation in the purchasing of rice to income. As income increases by 1% there is a 1.1% increase in rice purchasing. In the urban area the increase is less. If there is a 1% increase in income there is only a 0.8% rise in purchasing.

When one examines the linkages of consumption to prices, again there is a difference between urban and rural area. The major consideration is that 90% of the rural area has a rice stock or rice surplus at home from which to draw. If there is a 1% increase in the price of rice there is a 1% decrease in purchase. Purchases become marginal in the rural area.

On the other hand, since urban dwellers have no surpluses, they are more vulnerable and therefore, a 1% increase in price, will result in less of a decrease in demand. A 1% rise brings only a 0.5% drop in demand.

V. RECOMMENDATIONS FOR RESEARCH AT CARI

A. Agricultural Extension

Currently there is no outreach program for farmers and their families. Women need appropriate information on weaning food mixes from available sources at the village and household level. There should be included in the agricultural extension material, nutrition information which can be delivered simultaneously with agricultural information.

B. Animal Science

Fish provide important sources of both protein and, especially, calcium in the Liberian diet. Aquaculture research in inland waters should be promoted to guarantee a supply of these nutrients.

As fresh water ponds are promoted along side swamp rice agriculture, care must be taken to avoid pesticide residue contamination and toxicity.

C. Crop Science

Much has been written on iron toxicity of the soils. At the same time, a majority of the population suffers from anemia due to a combination of factors: malaria, hookworm, schistosomiasis and poor diet. A research project should investigate mineral content of soils (iron, zinc, and

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copper), plant uptake in the leaf and root of these minerals, analysis of these same minerals drawn from the family pot after cooking to trace the adequacy, and the form (as free minerals or compounds) from the plant to the plate.

D. Crop Science

After interviewing mothers as to their legume preference (groundnuts, cowpea, lima bean, mung bean) field research should be done to promote these crops to be used as protein supplements in weaning mixes to complement the rice and cassava gruels which are being given now.

E. Crop Science

Too much emphasis is being given to cassava research and not enough to sweet potatoes. Sweet potatoes have a much higher nutrient value than cassava and are used in similar ways in the diet. Both the leaves and the root are consumed.

F. Agricultural Economics

Cash cropping versus food cropping and their effect on family well-being and nutritional status is a current issue. Rice, citrus and oil palm are food and cash crops, while cocoa, coffee and rubber are exclusively cash crops. Most Liberian farmers have a mix of food and cash crops. Farm budget studies should be done to determine which mixes would give the highest return on diminishing land and labor inputs.

G. Rural Sociology

Demands for womens' time reach their peak during the hungry season (July, August, September), when they must plant rice. Womens' energy requirements include: maintenance, lactation, pregnancy and physical activity. To maintain energy balance, adjustments are being made. Comparisons of child birthweight, child growth of the exclusively breastfed child, number of miscarriages, and women's caloric reserve (fat fold) should be studied comparing the hungry season with the months of December, January and February to find out where compensation is being made to maintain energy balance.

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