781

PDBCB 978

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

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

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: SENEGAL

3. PROJECT NUMBER: 685-0285

4. BUREAU/OFFICE: AFR — 06

5. PROJECT TITLE (maximum 40 characters): NATURAL RESOURCES-BASED AGRICULTURAL RESEARCH

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 07 DD 31 YY 98

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

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
AID Appropriated Total	2,500	1,500	4,000	10,250	9,500	19,750
(Grant)	(2,500)	(1,500)	(4,000)	(10,250)	(9,500)	(19,750)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country					3,500	3,500
Other Donor(s)						
TOTALS	2,500	1,500	4,000	10,250	13,000	23,250

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) SS	120	020				4,000		19,750	
(2)									
(3)									
(4)									
TOTALS						4,000		19,750	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 060, 968

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)
A. Code: R/AG, BS
B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

To generate natural resources-based technologies that increase the productivity and sustainability of cereals-based cropping systems.

14. SCHEDULED EVALUATIONS
Interim MM 07 YY 94 MM YY
Final MM 04 YY 98

15. SOURCE/ORIGIN OF GOODS AND SERVICES
☐ 000 ☒ 941 ☐ Local ☒ Other (Specify) 935

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

Concurrence: Controller:WMcKeel W McKeel

17. APPROVED BY
Signature: Julius E. Coles
Title: Director USAID/Senegal
Date Signed: MM 07 DD 31 YY 91

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

MISSION ECPR

ISSUES PAPER FOR NATURAL RESOURCES BASED AGRICULTURAL RESEARCH PROJECT PAPER

USAID/DAKAR CONFERENCE ROOM

Country	Senegal
Project Name and Number	Natural Resources Based Agricultural Research (685-0285)
LOP Funding	$19.75 million
Planned FY 91 Obligation	$4.0 million
Authorization Venue	USAID/Dakar

I. Description:

The principal problem addressed by the Natural Resources-Based Agricultural Research project is Senegal's need for low-cost, natural resources-based agricultural technologies to reduce degradation of soils and forests and to increase the productivity of cropping systems. A major secondary problem is how best to strengthen the Senegalese Agricultural Research Institute's (ISRA) capacity to effectively carry out natural resources-based research.

The project provides a $19.75 million grant over seven years, funded from the Development Fund from Africa, with $4 million to be obligated in FY 1991. Its goal is to increase the productivity of cereals-based cropping systems in zones of reliable rainfall. Its purpose is the generation of natural resources-based technologies that increase the productivity and sustainability of cereals-based cropping systems for four selected cereals-millet, sorghum, corn and rice. It strengthens ISRA's capacity to do research on natural resources-based technologies. It emphasizes a farmer participatory approach to research and supports collaboration between ISRA and farmers associations, non-governmental organizations, the private sector, and public extension agencies on natural resources-based research.

The project provides four long-term technical advisors: research management, natural resources research, outreach, and financial management. It also funds short-term technical assistance in a variety of areas including agronomy, soil and water conservation, agroforestry, anthropology, biometrics, agricultural economics, sociology and management. It offers both long and short-term training in areas related to natural resources research and provides for commodity and direct support to ISRA's natural resources-based research program. It also provides funds for collaborative research activities involving ISRA and farmers'association, non-governmental organizations, private institutions and extension agencies and for research proposals in Senegal, site studies and sabbaticals to international, regional or US agricultural institutions.

The project seeks to achieve: (1) an improved natural resources-based research program at ISRA; (2) natural resources-based technologies validated and ready for adoption; (3) a strong farmer-participatory research system appropriate for designing, testing and validating research; and (4) management responsive financial systems and improved research management at ISRA. The program aims to produce technical approaches, tested on-farm and validated for economic potential which show promise for real increases in cropping system productivity.

II. Issues:

An Executive Committee Project Review (ECPR) on the Natural Resources Based Agricultural Research (NRBAR) PID was held in Washington on April 5, 1991. The ECPR cable, State 130946, attached as Annex B to the Project Paper, was sent to the Mission to guide the development of the project paper. The issues and concerns raised by Washington, and the Mission during project committee reviews of the Project Paper are presented and discussed below.

A. Issue #1. What is the appropriate project purpose and is a research approach the most effective means for achieving the purpose?

Discussion: AID/W felt that under the DFA mandate to more closely relate project investments to impacts a more appropriate project purpose is one of increasing the use of improved natural resources technologies rather than the generation of new technologies via research. The ECPR went on to question whether the greatest constraint to adoption was some factor other than research. The committee felt that the PID inadequately explained why the use of existing technologies was not spreading. The committee also felt that the linkage between adaptive research and the necessary institutional/policy environment to make replication likely was not adequately explained.

Mission Response: The design team and the Mission carefully considered modifying the project purpose to incorporate delivery of technologies to farmers. However, extension of technologies is being addressed by the World Bank and is beyond the manageable interest of this focussed research project. The Mission will be monitoring the adoption of technologies at the program level as part of the API exercise. Thus, the project purpose remains the "generation of natural resources based agricultural technologies that increase the productivity and sustainability of cereals-based cropping systems for four selected cereals..." The PID and the PP design team acknowledge that there are technologies developed by ISRA already in farmer's fields or ready to be tested on-farm. The PP design team placed emphasis upon documenting the technologies (the technology inventory is a pre-implementation action) and developing strategies (the collaborative research contracts between ISRA and PVO/NGOs) for dissemination of this information. The design team recognized that understanding the constraints to wide-adoption of NRMs technologies requires analysis and limited adaptive research through an active program of on-farm validation. The PP is clear that basic research (plant breeding, bio-technology, etc) would not be supported directly under the project.

As for policy changes which make a NRM's adaptive research/dissemination program a good investment, the analysis conducted in preparation for the Mission's CPSP, particularly the decline in soil fertility, indicated the compelling need to focus ISRA's attention upon adapting existing technology to deal with rapidly dwindling natural resources. The reduction of fertilizer subsidies has accelerated the farmer's focus upon low-cost management techniques more likely to produce sustained yields over costly input-oriented practices of the past. Price movements, anticipated if the structural adjustment under the PASA are enacted, will also tend to favor intensive production of food crops over cash crops in the long run.

The guidance cable also questioned the extension methodology proposed in the PID recommending an examination of the current GOS extension service. The World Bank has recently funded the Project National de Vulgarisation Agricole (PNVA). Our assessment is that this effort, based upon the Training and Visitation (T&V) model will fall short of the mark in extending NRMs-related technologies in the short term. Therefore, the PP design team incorporated a role for NGOs and farmer's organizations as a means of disseminating technologies to the target groups through the use of the collaborative research contracts program, and more direct contact with PVO's and NGOs in the design, elaboration, and evaluation of on-farm adaptive NRMs research.

Issue #2. Given the current state of ISRA and its dependence on a variety of donor support, is it timely to initiate a new ISRA research program in natural resources?

Discussion: A major management and financial review and analysis was incorporated in the design effort. This review indicated that despite ISRA's mandate to overhaul its management structure to fall in line with available resources, GOS funding levels remain inadequate to meet even salary costs. The guidance cable pointed out the discrepancy between planned donor-supported programs and GOS funding for recurrent costs. The AID review felt that imposing a "new" program upon ISRA would exacerbate the funding gap if there was not a corresponding reduction in the ISRA research program. The guidance cable relayed the review committee's concern that the proposed NRBAR project "be part of ISRA's institutional solution rather than contribute over the longer run to the problem of poor management, budgeting, strategic planning, and dependence upon donor funding and priorities." The cable recommended that the PP design team take further steps to establish a clear set of priority research objectives and related implementation plans and budgets and that the PP should examine ways to strengthen ISRA/GOS commitment to reform through specific conditionality/covenants in the project. The committee recommended that the PP design team consider increasing the level of assistance for overall ISRA management rather than concentrate most management assistance on the AID-funded natural resource component of the ISRA agenda. Finally, the guidance cable also recommended that the Mission state where it expects "ISRA to be with respect to institutional capacity and GOS coverage of recurrent costs by PACD."

4

Mission Response: Institutional reform of ISRA has begun. Preliminary downsizing of ISRA staff has begun; more reform is underway as part of ISRA's exercise to identify its hard core research program. It is unlikely, however, that without external technical and limited financial assistance, ISRA will be able to complete its transition. However, the retrenching has begun (several research station will be eliminated to reduce costs) and ISRA leadership feels confident that it can bring its costs into line with GOS financial support particularly if donor-assisted programs can contribute to ISRA's indirect research costs. However, the NRBAR program should not be interpreted as a "new" natural resources program. It is, in fact, support to work already begun several years ago under a variety of farming systems programs. The NRBAR seeks merely to focus the research work upon adapting existing technologies, testing them on-farm with non-traditional extension agents not creating new departments or new programs within ISRA.

The PP deliberately supports reducing ISRA's institutional problems not adding to them. The project devotes significant resources to assisting ISRA to resolve their management problems. For example, the chief of party position is a research planner who will assist ISRA's Director-General with planning and establishing priorities for all of ISRA's research work not just NRMs-related adaptive research programs. The chief-of-party will coordinate efforts with the World Bank and other donors to rationalize ISRA's emerging national program. The Project Paper sets aside funds for donor coordination meetings to further attempt to assist in the clarification of research objectives. In terms of improving ISRA's financial management, the financial analysis work and the financial management advisor position will improve ISRA's accounting and financial control systems not concentrate upon setting up a separate, distinct system for the NRBAR project. Finally, funds are set aside for in-country training of ISRA's administrative staff both at headquarters and at the station level.

It is difficult to predict with certainty where ISRA will be by the PACD. Much depends upon the speed with which the current reforms are undertaken. We are convinced that the measures planned can, with consistent and prudent financial management, bring ISRA into line with currently planned financial resources.

Issue #3. "Should funds be reserved for research grants and protocols with non-government organizations, farm organizations, and input suppliers, and how can this funding be most demand driven?"

Discussion: The Project Committee expressed its concern that the approach implied in the PID was that the client for the research is a public sector entity (ISRA) thus raising concern with regard to the "ownership" of the

research agenda. The committee was also concerned about the quality of the research proposed to be carried out by PVO/NGO groups despite, Rodale and Winrock's reputation. Washington was concerned about funding of organizations not constituted or qualified to conduct agricultural research. AID/W recommended an approach to establish protocols for the private sector to contract with ISRA to conduct research of particular interest to the private sector, leading to better downstream linkages and increased utilization of the end-products of the research conducted.

Mission Response: The Mission recognized the limited capability of most NGOs and PVO's to collaborate scientifically with ISRA in the conduct of on-farm research work. However, the PP design team continued to find that these groups represented the best potential to guide ISRA's research toward specific felt needs of the farmers and an excellent means to continue to nudge ISRA toward farmer participatory research work. The social analyst for the design team focussed specifically on this question and considered PVO/NGO's the best available option for developing feedback loops for demand driven research. The PP describes the concept of the collaborative research contract grants program linking PVO/NGO/farmer groups (the clients) with ISRA via a multi-year research protocol with built-in "deliverables" (research results, verifiable indicators). The development of this program is the direct responsibility of the technical assistant contract grants coordinator.

Issue #4. "Would it be beneficial to the long-term institutional development of ISRA to offer research grants to ISRA employees to conduct research at ISRA? Would such grants constitute "salary supplements"?

Discussion: The AID/W review committee was concerned that the use of competitive grants programs would disrupt ISRA's on-going work tending to attract ISRA researchers away from other priority research projects. The guidance cable suggested that this element of the project be designed grants to individuals are closely related to the project purpose and that the Mission should consult with the RLA/Dakar to address the salary supplement issue in the PP.

Mission Response: The research grants program has been substantially revised from the PID stage. The collaborative design team consisting of ISRA staff and Mission staff carefully assessed both the mechanisms and the implications of this component. Three types of grants for ISRA are proposed: 1) grants for research in Senegal; 2) site studies; and 3) sabbaticals. The research in Senegal would provide limited operational support to on-going NRMs-related research work (funds for an additional short-term staff, for example) to accelerate impact. Up to three grants are planned annually not to exceed $10,000 per grant. The site studies would be grants to researchers to visit on-going research work in neighboring Sahelian countries or other

countries where NRMs relevant work, similar to work done in Senegal, is being conducted. The technical assistance team will assist with the planning of site visits to coordinate efforts. The sabbaticals, which will begin in year 3 of the project will offer up to two, three-to-four month sabbaticals per year to enable researchers to participate in research work at different research institutions (probably IARCs, branches of IARCS such as the ICRISAT center in Niamey, or U.S. universities)). This will be problem-oriented work done collaboratively with the host institution. The grants program is innovative and the idea has been extremely well-received by ISRA. It is intended to strengthen the focus upon NRMs research not dilute or diffuse ISRA's on-going research efforts.

The Regional Legal Advisor has reviewed the issue of salary supplements and has concluded that none will be paid under these research grants. The ISRA staff will continue to receive salary from the GOS in all cases. There will be no payments for salary supplements. However, authorized per diem will be paid for site visits and costs for lodging and expenses under the sabbatical program will be paid by the project.

Issue #5: "How should the Project be Implemented?"

Discussion: The AID/W committee felt that a Title XII contracting mode was recommended given current agency policy. The Mission stated, however, during the PID review that it preferred not using Title XII in hopes of attracting interest from groups with specialized experience in low-cost appropriate technologies. AID/W recommended three options including the development of the terms of reference for the Request for Technical Proposal to encourage Title XII applicants to team up with non-university entities with specialized expertise.

Mission Response: The Mission agreed with the proposed option of a limited competition linking a Title XII institution with a non-university entity, cabled the Mission's position and received confirmation that this approach was acceptable to Washington. (State 223993, dated 10 July 1991).

Issue #6: Financial Management Technical Assistance:
Is it realistic to expect that ISRA's financial management problems can be turned around using additional T.A. as planned in this activity? The primary purpose and objectives of the financial management assistance to be provided are not clear in the PP, i.e., what do we expect the end-product to be at ISRA as a result of the provision of 3 person-years of Technical Assistance?

Discussion: The financial strengthening aspects of the project require serious review. Previous efforts to improve financial and budget control have had limited success. ISRA has noted serious weakness in its staff in numbers and training and both at headquarters and at the station level. ISRA has embarked upon reform measures and requires additional administrative and financial training and assistance with computerization to complete their up-grading. They state that rather than working within a unified, ISRA/GOS accounting system each of the numerous donor projects currently underway with ISRA create separate and accumulating burdens upon ISRA's already weak financial administration structure. They argue for strengthening of the existing system, staff training, and streamlined, simplified procedures.

The GOS has mandated reform within ISRA. It is a slow process and requires outside assistance. From recent discussions with ISRA, we understand that the World Bank funded agricultural research project has funds for and is prepared to finance necessary support for some aspects of the reform of ISRA's accounting and financial administration section. (The World Bank, for example, has agreed to fund an "audit" of ISRA's finances for 1989 and 1990 and for 6 years into the future.) This will be of some assistance, however additional work remains.

Mission Response: The Project Paper design team elaborated a strategy under which pre-implementation activities included the use of a "SWAT" team to review ISRA's financial systems and condition, to determine the level and validity of current arrearages, and to make recommendations aimed at improving ISRA's overall financial management performance. This pre-implementation activity would set the stage for the beginning of a three person-year financial management advisor to be assigned to ISRA. The financial advisor will be tasked with carrying out financial management reform ISRA-wide. The advisor will have a senior counterpart and the Mission has been assured that ISRA will provide the needed support for reform. The financial management advisor is to review the current ISRA system as well as the individual systems put into place under current donor funded projects and help ISRA to regain control over the numerous system being utilized.

Concern #1: AID/W recommended that monitoring of research impacts be carefully conducted and that mechanisms be built into the project paper to ensure impact upon agricultural productivity.

Discussion: The ECPR guidance cable, concerned over monitoring and impact measurement, suggested that this concern be incorporated into the institution building aspects of the project. The cable went so far as to suggest "...at the project output level, the project should include the development of monitoring and evaluation capacity to assess and document the impact of the agricultural research that will be funded."

8

Particular attention will need to be given to monitor the impact of this investment. It is important that impact measurement be incorporated into the institutional development approach to be promoted with ISRA. The Mission feels that the impact of the agricultural technology can be measured (the planned technology inventory will serve as a baseline). The broad issue is whether or not the ISRA institutional building aspects can be monitored and the methodology developed to monitor the impact of the research efforts in a sustainable manner within ISRA and with resources likely to be available to them after the project.

Funds for project monitoring and evaluation were increased as a result of the first Mission review of the project paper from $350,000 to $525,000.

Mission Response: The development of monitoring and evaluation capacity to assess and document the impact of agriculture research should be developed early in the life-of-project. Institutional monitoring should be at the output level of the project and not at the input level as is traditionally the case. Farmer adoption impacts of this project will be monitored at a programmatic level. The Mission's quantifiable indicator design work, now underway should help develop specific guidance for the NRBAR project.

Concern #2: It was not clear how research and extension strategies will take into account gender role in society and suggested that gender data be disaggregated.

Mission Response: AID/W provided a three week TDY from the Women in Development Office to assist the Mission with the review of its on-going portfolio and to develop the WID action plan. During this TDY, careful review of the NRBAR project was done and recommended changes incorporated into the PP.

Concern #3: The AID/Washington ECPR cable points out in paragraph 9 that if the Agricultural Sector Grant is not approved before the PP is completed, the PP must include a discussion on how the GOS contribution requirement will be met. It proposed that a waiver of the 25% host country contribution could be requested if the Agricultural Sector Grant is not approved in time.

Mission Response: The Agricultural Sector Grant will not be approved before the PP is authorized and no funds from local currency generations have been budgeted in the project. A waiver of the 25% contribution from the host country has been requested. Furthermore, the GOS has pledged a minimum of 1.4

billion CFA to ISRA's recurrent costs as a condition of the World Bank loan for agricultural research.

Concern #4: The guidance cable reminded the Mission to include a discussion of the Gray Amendment in its procurement plan.

Mission Response: There is a discussion of the Gray amendment on page 30 of the Project Papor.

Concern #5: The guidance cable suggested including an anthropologist or a rural sociologist on the project paper design team.

Mission Response: A socio-economist was recruited for the design team to complete the social soundness analysis. This work was reviewed by an ISRA PhD rural sociologist recently returned from long-term training at Michigan State University. He has agreed to participate with the technology inventory team and with the preparation of the scopes of work for the contract technical assistance team.

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Gary Nelson, Deputy Director
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TABLE OF CONTENTS

	Page
Project Data Sheet	
Action memo for the Mission Director	
Mission ECPR	
Project Authorization	
Table of Contents	
List of Acronyms	i
I. Executive Summary	1
II. Project Description and Rationale	2
A. Perceived Problem	2
B. Project Goal, Purpose and Expected Achievements	4
C. Project Outline and Strategy	6
D. Project Elements	10
1. Research-Support	10
2. Support for ISRA's Natural Resources Program	15
3. Linkages to Regional and International Research Institutions	15
4. Technical Assistance	17
5. Training	18
6. Commodities	19
7. Audit and Evaluations	20
III. Program Factors	21
A. Conformity with GOS Priorities	21
B. Africa Bureau Strategy	21
C. USAID Strategy and Relevant Experience	22
D. Other Donor Experience	22
IV. Cost Estimate and Financial Plan	25
A. Introduction	25
B. Budget Summary	25
C. Disbursement Plan	25
D. Financial Control	26
E. Methods of Implementation and Financing	28
V. Implementation Plan	29
A. Introduction	29
B. Contracting and Gray Amendment	29
C. Responsibilities	30
D. Implementation Schedule	34
E. Procurement Plan	39
VI. Summaries of Project Analyses	41
A. Technical Analysis	41
B. Economic Analysis	46
C. Financial Analysis	53
D. Institutional Analysis	58
E. Social Soundness Analysis	62

VII. Monitoring, Evaluations and Audits 67

VIII. Conditions and Covenants 74

Annexes

A. Grantee Request for Assistance
B. PID Review and Approval cables
C. Logical Framework
D. Statutory Checklist
E. Technical Analysis
F. Institutional Analysis
G. Social Soundness Analysis
H. Procurement Plan for Commodities and Services
I. Bibliography
J. Initial Environmental Examination
K. Scopes of Work for Technical Assistance
L. Implementation Schedule chart

LIST OF ACRONYMS

ACP	Agent Comptable Particulier
ADO	Agricultural Development Office
AFR/TR	Africa Bureau Technical Resources
CEE	Communaute Economique Europeenne
CEP	Centre des Etablissements Publics
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CIRAD	Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement
CORAF	Conference des Responsables de la Recherche Agronomique Africains et Francais
CRSPs	Collaborative Research Support Programs
DFA	Development Fund for Africa
FAO	Food and Agricultural Organization
FED	Fonds Europeen de Developpement
GDP	Gross domestic product
GOS	Government of Senegal
IARC	International Agricultural Research Center
IEE	Initial Environmental Threshold Examination
ICRAF	International Center for Research on Agroforestry
ICRISAT	International Crop Research Institute for Semi-arid Tropics
IDRC	International Development Research Center
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Center for Africa
ILRAD	International Laboratory for Research on Animal Diseases
INTSORMIL	International Sorghum and Millet Program
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
ISRA	Senegal Agricultural Research Institute
NARS	National Agricultural Research Services
NGO	Non-governmental organization
NRM	Natural resources management
OE	Operating Expense
ORSTOM	Office de la Recherche Scientifique et Technique Outre-Mer
PID	Project identification document
PIO/T	Project Implementation Order/Technical
PIO/C	Project Implementation Order/Commodities
PP	Project paper
PNVA	Project Nationale de Vulgarisation Agricole
PVO	Private Voluntary Organization
REDSO	Regional Economic Development Support Office

RFTP	Request for Technical Proposal
SAFGRAD	Semi-arid and Food Grain Research and Development
SPAAR	Special Program for African Agricultural Research
T & V	Training and Visit
USAID	U.S. Agency for International Development, Senegal Mission
WARDA	West Africa Rice Development Association

15

I. Executive Summary

The principal problem addressed by the Natural Resources-Based Agricultural Research project is Senegal's need for low-cost, natural resources-based agricultural technologies to reduce degradation of soils and forests and to increase the productivity of cropping systems. A major secondary problem is how best to strengthen the Senegalese Agricultural Research Institute's (ISRA) capacity to do natural resources-based research.

The project provides a $19.75 million grant over seven years, funded from the Development Fund from Africa, with $4 million to be obligated in FY 1991. Its goal is to increase the productivity of cereals-based cropping systems in zones of reliable rainfall. Its purpose is the generation of natural resources-based technologies that increase the productivity and sustainability of cereals-based cropping systems for four selected cereals-millet, sorghum, corn and rice. It strengthens ISRA's capacity to do research on natural resources-based technologies. It emphasizes a farmer participatory approach to research and supports collaboration between ISRA and farmers associations, non-governmental organizations, the private sector, and public extension agencies on natural resources-based research.

The project provides four long-term technical advisors: research management, natural resources research, outreach, and financial management. It also funds short-term technical assistance in a variety of areas including agronomy, soil and water conservation, agroforestry, anthropology, biometrics, agricultural economics, sociology and management. It offers both long and short-term training in areas related to natural resources research and provides for commodity and direct support to ISRA's natural resources-based research program. It also provides funds for collaborative research activities involving ISRA and farmers'association, non-governmental organizations, private institutions and extension agencies and for research proposals in Senegal, site studies and sabbaticals to international, regional or US agricultural institutions.

The project seeks to achieve: (1) an improved natural resources-based research program at ISRA; (2) natural resources-based technologies validated and ready for adoption; (3) a strong farmer-participatory research system appropriate for designing, testing and validating research; and (4) better financial and research management at ISRA. The program aims to produce technical approaches, tested on-farm and validated for economic potential which show promise for real increases in cropping system productivity.

II. Project Description

Summary: This project paper describes a $19.75 million, seven-year project, the Natural Resources-Based Agricultural Research Project, to address the problem of Senegal's deteriorating natural resources base. Its goal is to increase the productivity of cereals-based cropping systems in zones of reliable rainfall. It supports the Senegalese Institute for Agricultural Research (ISRA)'s efforts to generate natural resources-based technologies that increase the productivity and sustainability of cereals-based cropping systems for four selected cereals--millet, sorghum, corn and rice. It provides technical assistance to strengthen ISRA's research planning and management and its financial systems. It will provide technical assistance, commodities, participant training, and financing for program support and research grants. Funding will come from the Development Fund from Africa.

A. The Problem

Senegal's fragile natural resources base is at jeopardy with serious implications for agricultural productivity and rural incomes. Population growth, combined with poor cultural practices, has placed an increasing stress on soil containing very little organic matter and subject to wind erosion and salt-water intrusion. Soil fertility is declining, and as farmers move on to new land, clearing forest and shrub cover, new areas are being put at risk. As a result, where forests have been cleared, up to 30 percent of organic matter has been lost and yields per hectare are falling off at a rate of one percent per year.

In parts of the groundnut basin, Senegal's most intensively cultivated and densely populated rural area, soil productivity is declining at a rate of 3-5 percent per year. In the Casamance and Senegal Oriental, pushed by population pressures, farmers are mining the soil, cutting and clearing more land, all of which increases erosion, reduces efficient water use, and lowers yields.

Decreasing yields have obvious consequences for Senegal's ability to feed its population. Agricultural production has been unable to keep pace with population growth. Growing enough cereal to meet 60-70 percent of its needs at independence, Senegal is now producing closer to 50 percent, insufficient to meet even the requirements of its rural population. Unless serious efforts are made to improve soil and water management on land now in cultivation and to protect newly opened lands, income growth in rural areas will not take place. Declining food and cash crop production will be a certainty.

Applying low-cost technology can offer some hope. A recent inventory of technological interventions carried out by the Mission's Agricultural Development Office as part of its Agricultural Sector Assessment cited a number of studies that clearly demonstrated the ability of farmers to increase soil fertility and raise productivity through adoption of low-cost,

natural resources based technologies. Some technologies were already in use on farmers' fields; others were available for adoption. They included improved land preparation, better weeding practices, improved seeding, crop rotation, water and erosion control, and agroforestry management. Use of nitrogen-fixing trees, acacia albida, for example, increased crop yields as much as 150 percent; composting and use of organic fertilizers produced an 80 percent increase; windbreaks and live fences increased yields 15-30 percent; and ridges and gully controls raised yields 50 percent.

Moreover, research carried out by ISRA and Michigan State University clearly demonstrate that the impact of capital-intensive technologies--pesticides and fertilizers--depends heavily on natural resources management. They show that soils are so degraded and moisture availability so erratic that plants cannot use nutrients from chemical fertilizers efficiently. Resources management technologies also have the advantage of generally requiring less cash than do chemical inputs, thus making them more acceptable to farmers hesitant to invest in new technologies when substantial variations in rainfall--often 20-30 percent--make such investments risky. Finally, there is evidence that farmers themselves have begun to adopt resources management technologies. A recent study by Michigan State researcher James Seyler argued that farmers in the groundnut basin, realizing the extent of degradation, have begun to return to classic natural resources management strategies of fallow and regeneration.

Developing a better understanding of natural resources management technologies that work in Senegal is critical to USAID's long-term strategy of reversing, over the next 15 to 20 years, the current trend of deteriorating soils and declining forests. The strategy depends on establishing a research system able to identify and adapt known natural resources management technologies and to test them in a collaborative approach that convinces farmers and encourages them to use the technologies. Validating the potential of these technologies, despite their lower costs, may be particularly difficult because it often takes time for their benefits to accrue. Some measures require taking land out of production, with real implications for food and land security, and others take considerable farmer time and labor. To be successful, the research approach must incorporate farmers into the process, creating a research-testing-demonstration-research feedback system that informs farmers of what works and researchers of farmers' priorities.

ISRA, Senegal's agricultural research institute, has certain strengths that make development of such an approach possible. With help from the World Bank, USAID and other donors over the last eight years, ISRA has moved from a fragmented, largely on-station, research system focused on individual crops to a national research institution doing multidisciplinary research with an on-farm production systems network. It has a small core of talented scientists and linkages to international research institutions. It has taken major steps to reorganize and reform its management structure to improve use of personnel.

Nevertheless, much remains to be done. ISRA's past focus has not been on natural resources-based technologies but on traditional, crop-specific approaches. Soil research in the Sahel has meant soil analysis, soil classification and mapping, soil labs and fertilizer-crop response tests. Water resources research has focused on high-technology irrigated approaches. Such research has neglected critical issues of soil conservation, erosion, and infiltration management and other techniques for improving soil structure and fertility. Moreover, research often has been narrowly confined to specific disciplines along departmental lines. Natural resources-based agricultural research provides an opportunity for encouraging interdisciplinary research.

B. Project Goal, Purpose and Expected Achievements

Goal: The goal of the Natural Resources-Based Agricultural Research Project is to increase the productivity of cereals-based cropping systems in zones of reliable rainfall. The potential for increased agriculture productivity is bounded by weather. Only eight percent of Senegal's arable land is suitable for irrigation and analysis has shown irrigation of food crops to be uneconomic without subsidies. The rest must depend on Senegal's erratic rainfall. The minimum annual rainfall required for successful rainfed agriculture is 400 mm distributed appropriately throughout the growing season and occurring four years out of five. Agriculture in areas with less rainfall--primarily in the northern half of Senegal since the 400 mm rainfall line bisects the country--is extremely marginal. The northern zone is highly vulnerable to wind erosion. Advanced stages of soil degradation and high population densities make development of a sustainable production system there difficult, if not impossible. Therefore, the project focuses on crop productivity in the more favorably endowed southern zone of the country, an area that includes approximately 75 percent of total usable land in Senegal.

Purpose: The purpose of the project is to sustain the generation of natural resources-based technologies that increase the productivity and sustainability of cereals-based cropping systems for four selected cereals--millet, sorghum, corn and rice. As productivity has dropped, farmers have increasing problems meeting their food security requirements. At the same time, the potential for increasing the value of cereals production exists. Millet, sorghum, corn and rice account for 60 percent of total cropped area in the zone below the 400 mm rainfall line. Increasing production in these areas would have wide impact on local incomes. In the project zone rice can be grown and processed profitably at the village level at prices competitive with alternative cereals, particularly imported rice. Corn production and processing have been increasing steadily. There are significant opportunities to improve on both through the project.

The focus on low-cost natural resources management techniques--improving soil, water and vegetative cover and integrating livestock, trees and crops into production systems--is the key to increasing soil productivity and building better, sustainable production systems. It leaves aside direct support for crop breeding, opting instead for screening and evaluating genetic material developed elsewhere. It also de-emphasizes reliance on conventional inputs such as high cost packages of fertilizers and pesticides to increase productivity except in areas where soil fertility and rainfall make their use viable. Farmers lack the funds and credit for purchasing inputs without subsidies, but they can improve soil moisture and organic material content by marshalling more effectively the resources they already have at their disposal.

C. Expected Achievements: To generate natural resources management technologies that can make a real difference in cereals-based cropping systems productivity will require four project achievements: (1) an improved natural resources-based research program at ISRA, (2) natural resources-based technologies validated and ready for adoption, (3) a strong farmer-participatory research system appropriate for designing, testing and validating research, and (4) better financial and research management at ISRA. The project will develop at ISRA a more effective, adaptive research program focusing on cropping systems and natural resources management; soils and water management; forestry and agroforestry; improved cultural practices for four selected crops--millet, sorghum, corn and rice; and applied economics addressing both micro and sectoral issues relating to these cropping systems. The program will produce technical approaches, tested on-farm and validated for economic potential, which show promise for real increases in productivity.

The project will encourage substantially strengthened linkages within a network comprising ISRA, its constituents in the private sector, the extension service, and grassroots organizations capable of cooperating in adaptive research and in transfer of adapted technologies to the field in significant quantities. Within Senegal the project will improve research-extension-research linkages, increasing feedback from farmers to ISRA on research results and from ISRA to farmers on appropriate and sustainable technologies. By the project's end, ISRA will have established a system for collaborating on the testing, validation and evaluation of technologies it has developed. It will have signed protocols with NGOs, farmers' organizations, agricultural input suppliers or other non-traditional extension agents, to test technologies on farm, get results back to ISRA, enable farmers to inform ISRA of their priorities, and help ISRA respond directly with new technologies. The emphasis on collaborative farmer participatory research will increase the likelihood that technologies, once validated, will be adopted. Funded under a World Bank project, ISRA will also be working with the public extension service.

On a wider level, the project will support collaboration between ISRA and key international and national research institutions on research on natural resources management, cropping systems, and adapted technologies. ISRA will have signed protocols and ongoing programs with these centers for joint research, training and technical assistance addressing specific, practical issues involving soil conservation and moisture management.

The project will strengthen ISRA by improving its research planning and financial management. Research programs will have clearly defined objectives achievable in the medium-term; research plans will be regularly reviewed and priorities set; the financial system will provide satisfactory accountability and control; research programs and priorities will be linked to budget realities and manpower plans; and donor funding coordinated. To the extent necessary, ISRA personnel will have been trained and upgraded, and ISRA will have introduced a system of grants for individually proposed research programs, providing effective incentives for innovative farmer participatory research.

C. Project Outline and Strategy

USAID's strategy under the project is to focus on increasing the productivity of cereals-based cropping systems by generating natural resources-based technologies in zones of reliable rainfall. The means for implementing the strategy is to establish at ISRA a program for generating and field testing natural resources-based technologies and for getting them out for validation on farmers' fields.

The analyses summarized in a later section of this paper make the case for such a program. The agricultural sector assessment carried out by USAID in 1990-91 clearly described the consequences of soil degradation and the potential for improved cropping systems productivity through better use of natural resources. The economic analysis confirms this potential and the technical analysis suggests a number of areas for further work. The social analysis, while confirming the importance of research on natural resources-based agricultural technologies, emphasizes the importance of farmer participation in research to ensure that the research is of priority to its principal beneficiaries and to increase the likelihood of its adoption. The financial and institutional analyses describe key systemic changes that must be made in ISRA's management if it is to be able to carry out an effective program.

Management: It is clear that in order for ISRA to have the impact sought by the project in developing natural resources-based technologies, it will need to improve its management. In the recent past, ISRA has been beset by a financial crisis and by related organizational problems. It has had difficulty defining its research plans and aligning its program priorities and staff to financial realities. Driven by the financial crisis, it has been forced to undergo a series of restructurings, affecting morale and interrupting regular lines of communication. Where it has had management systems in place, it has lacked trained staff to take

advantage of them. But more frequently, management has lacked both the systems and personnel to allow it to plan, execute and evaluate a coherent program addressing farmer needs.

At the same time, ISRA's restructuring and the acuteness of its current financial situation create an opportunity for technical assistance to have a real impact on its operating effectiveness. ISRA is being forced to reduce its staff and program to a manageable core. The project will provide technical assistance and training in financial and research management and administration to strengthen ISRA's capacity to do this, to manage its organization and to plan and carry out its research. It also will provide technical assistance to shape ISRA's approach research.

Approach to research: As pointed out in the technical and institutional analysis, ISRA has been criticized in the past for failing to produce research of consequence to farmers. Past critiques of ISRA's work include: (1) commodity research programs that are inordinately oriented toward plant breeding; (2) food crop research that concentrates excessively on improved technologies and purchased inputs rather than on low-cost technologies that improve upon traditional practices; (3) crop-specific and farming systems research programs that do not address farm-level constraints; (4) lack of farmer and extension agency participation in research planning, design, execution, and evaluation; (5) lack of integration of livestock and cropping systems research.

The tie between ISRA and the farmers it is trying to help is not fully developed. ISRA has had formal linkages and working arrangements through protocols with public sector extension agencies, although severe financial constraints have meant that during the last five years little collaboration has ocurred. For example, ISRA has not held an annual research review, important to provide grass roots input into research planning and for feedback from tests on farm, in the last three years. Work with "non-traditional" extension agents--farmers' organizations, NGOs, village groups, input suppliers, universities and other non-governmental research organizations able to carry out on-farm trials has been extremely limited. The end result is that not enough of the research done by ISRA has been adopted by farmers.

The social soundness analysis makes it clear that to succeed a research program must be directed at farmers needs, designed and implemented with farmer participation. There are traditional and professional hurdles to instituting a strong, demand-driven research program at ISRA. Scientists will need to overcome prejudices about farmers' ability to work on research and farmers will need to overcome their own inhibitions and feelings of dependence. ISRA itself needs mechanisms that encourage greater collaborative research.

The project will actively encourage ISRA to develop an approach to research that emphasizes farmer participation. It will help ISRA establish or revitalize linkages to outreach organizations in Senegal, both public and private. It will provide technical

assistance and funding for ISRA to set up a small grants program to encourage innovative collaboration with NGOs, private sector institutions and farmers associations. The program will fund meetings with farmers, joint researcher-farmer observation tours and training sessions, and joint research projects. It will provide support to ISRA researchers with innovative ideas and funds for projects involving researchers from outside ISRA. It will also fund sabbaticals for ISRA researchers interested in looking at approaches to natural resources-based agriculture and will strengthen linkages to international and national research institutions by sponsoring visits and exchanges of staff.

Concentration on natural resources-based technologies: The substance of the project differs from other research efforts in several different ways. First, it concentrates on natural resources-based technologies for cropping systems involving four selected crops--millet, sorghum, corn and rice. It accepts the premise, outlined in the social soundness analysis, that farmers' incomes are based on a strategy of diversification. It begins with an effort to understand these strategies and take advantage of low-cost natural resources-based technologies already practiced by farmers in Senegal, which, when modified, can be adopted more widely. Building on the farming systems research approach developed under the current Agriculture Research II Project, a first step in the new project, to be carried out during the pre-implementation phase, will be to inventory existing natural resources management techniques already used by innovative farmers, to analyze the social and economic factors affecting their adoption, and to identify promising practices for research and validation.

Second, the project focuses on adaptive research. Two decades of work by both the international community and Senegalese scientists have demonstrated the difficulties of making significant advances in Senegal through plant breeding, particularly for its principal cereal crop, millet. Experts caution that while plant breeding should continue for millet and sorghum, improving varieties will be a long, costly and highly specialized affair, a task best left to the international research centers and others with better resources. Any genetic materials and related technical assistance for this project will be supplied through the linkage program with outside international or national research institutions.

Third, it will strengthen ISRA's interdisciplinary research teams. Finding the appropriate combination of crop rotations and associations, agroforestry, soil and water management, varietal improvement and organic and chemical fertilizers will require a balance between commodity and natural resources-based agricultural research built on an integrated systems approach. ISRA's regional interdisciplinary teams can integrate technical themes with the socio-economic research required to validate them, and the project will provide funds and technical assistance to support interdisciplinary research.

In analyzing the technical problems to be addressed by the project, ISRA outlined three broad thematic areas that cut across regions: soil fertility, watershed management, and farming systems, including the role of livestock and general agronomy. The project will focus on these three themes applied to the three regions that fall into the project's target area, the zone receiving 400 millimeters or more of rainfall annually. In each region, local conditions will affect the type of activity selected to pursue the themes; listed below, illustratively, are some of the types of activities to be undertaken with project funding and technical assistance. They are described in greater detail in the technical analysis.

Soil fertility: Population pressures have encouraged intensified cultivation, farming of marginal lands and reduced fallow periods. The result, loss of organic matter, soil compaction, sealing, wind and water erosion, have dramatically cut into soil fertility. In some areas, such as Senegal Orientale and Haute Casamance, lack of vegetation and low organic matter content have encouraged acidification.

There are a number of approaches to increasing soil fertility including fallow systems, composting, alley cropping, line plantings, windbreaks and live fences, mixing of natural and organic fertilizers. Improved fallow systems introduce woody, grasses perennial and legumes into farming systems which provide organic matter, fuelwood, forage supplies and soil stabilization. Composting introduces nitrates and phosphates into the soil and increases organic content. Alleycropping and line plantings provide green manure and barriers against erosion. On-farm field trees and field tree mosaics can help reduce acidification.

Some techniques such as improved fallow systems, composting and improved mixing of organic and mineral fertilizers can contribute to increased soil fertility throughout all regions, the Peanut Basin, Senegal Oriental and Casamance, within the project's zone. Others may be more relevant to specific regions, such as alley cropping to Senegal Orientale and Casamance and line plantings in the Peanut Basin.

Watershed management: Population pressures have pushed farmers to clear more land for agriculture and to remove vegetation for construction, animal feed and firewood, leaving soil exposed to wind and water erosion. Tilling and complete removal of peanuts, including roots, reduces organic matter and destroys soil structure and resistance to erosion. The problem is complicated by soils that tend to crust and seal, preventing water infiltration, increasing run off and encouraging sheet wash and gully erosion. In the Casamance, clearing of vegetation has produced downstream soil erosion and valley land siltation and reduced the flow of fresh water underflow into the lower valleys, increasing salt water encroachment. Contouring, strip cropping and better tillage practices can reduce surface runoff, increase infiltration and resistance to wind and water erosion. Tied ridges, rockbunds and microcatchments help to catch and hold water after a rain, slow run

off and increase infiltration. Vegetation barriers can play a similar role, as can mulching and natural forest management, while providing secondary benefits such as forage, fodder, and medicinal plants.

Farming systems, including general agronomy and integration of livestock: Intercropping and crop rotation can increase ground cover, return organic material and fix nitrogen, as well as add income through forage and fodder crops. Important as part of the total system is the role of animals, cropping to increase fodder, use of manure, and improved animal traction. The integration of traditional commodity research with natural resources-based agronomic and socioeconomic research, on-farm testing of improved varieties in conjunction with improved cropping systems and cultural practices can strengthen the impact of commodity programs. In some areas, work on specific tree species such as acacia albida and cordyla pinnata or types of living hedges may be particularly appropriate.

Socio-economic factors, such as land and tree tenure, labor constraints and access to resources, play a critical role in the determining farmer decisions concerning the use of these technologies. Interdisciplinary research in these areas, funded by the project, will clarify farmers' opportunity costs and choices. In some cases, ISRA already has considerable experience with the technology; research will focus on refinements and general appropriateness. In other cases, the technologies will be new to ISRA, requiring a greater commitment of staff time to generate. Throughout the process, increased farmer participation will check the relevance of technologies and increase the likelihood of adoption once appropriate approaches are identified.

D. Project elements

The project will encourage ISRA to be more innovative both in the substance of its research and in the way it carries it out and communicates its results. The project will support aspects of ISRA's on-going natural resources-based research and offer financial and technical assistance to expand its natural resources research programs. It will not develop an independent program within ISRA, but will help ISRA build a sustainable research program on natural-resources-based technologies as part of its overall research program.

1. Research support

Development of an effective natural resources-based research program will depend on effective farmer participation in research planning, field trials and evaluation. It will also need innovative proposals from ISRA scientists for interdisciplinary research. The project will encourage both by establishing a grants program to provide $2,150,000 in funds for collaborative research involving ISRA, NGOs, farmers' associations and extension agencies and $1,320,000 for ISRA scientists involved in interdisciplinary natural resources research. It will also provide $1,000,000 in budget support for expansion of ISRA's ongoing program of natural resources-based research.

A. Collaborative Research Grants

The purpose of the research grants program is to increase the number of trials and quality of farmer participation in the design of ISRA-conducted on-farm field trials and evaluations of natural resources-based agricultural technologies. The project will help ISRA develop a system of directed research grants for a set of clients which includes farmers' organizations, NGOs, village groups, input suppliers, universities, other non-governmental organizations and public extension agencies. (The inventory of natural resources technologies planned during the pre-implementation phase of the project will serve as a starting point for selecting technologies for on-farm testing.) Joint activities involving ISRA, private firms, NGO's and extension agencies will test and validate technologies identified in the inventory or already developed by ISRA, on farm, in a practical rather than a purely scientific sense. The effort will establish a tighter research-testing-research feedback system. This will permit promising technologies to be tested collaboratively on farm, facilitate the feedback of on-farm trials to ISRA, facilitate farmers access to ISRA and to the establishment of even greater farmer-oriented research work. Finally the proposed collaborative research grant proposal will provide an opportunity for ISRA to be a partner in the diffusion of new technologies.

To formalize the collaboration, ISRA will sign protocols with selected NGOs, farmer groups, and extension agencies. The protocols (or collaborative research contracts) will identify the research problem, the proposed response, as well as the length of time and the resource levels required to carry out the work. A multi-year budget will be prepared which will provide funding for start-up costs and pro-rate payment of the balance upon the submission and acceptance of "deliverables" - progress reports, research plots established, i.e., measurable indicators of progress toward agreed upon objectives. One objective of the collaborative research contract program is to establish a firm link among ISRA and its clients and to give the clients a greater role in the establishment of the research agenda. The Mission is exploring several methods of disbursement procedures for these grants. Final guidance will be issued in a PIL.

A research review committee, chaired by ISRA, but including representatives from NGOs, the government extension agency, the university and the project's technical assistance team, will review and select proposals based on their quality and relevance. The review committee will meet at least twice a year, in February-March, to review proposals and plan a program, and in August-September to review implementation. Once a national committee is establishedand operating effectively, ISRA will set up a mirror committee at the regional level to provide advice to the national committee.

ISRA will nominate a representative as research contracts coordinator to work directly with the natural resource research grants advisor on the technical advisory team. The ISRA coordinator will work directly under ISRA's Director of Scientific Research and

will serve as secretary of the grants committee, not as a voting member. He will work with the research contracts advisor to establish a mechanism for implementing and monitoring the program, reporting on progress and evaluating impact.

The research contracts will cover operations (such as gasoline, per diem, supplies, computer time, hiring up to two research assistants). In certain cases where commodity support is required and justified, the procurement of limited equipment will be permitted. (Procurement will be charged to the research contract program activity not individual contracts.) Most contract grants will be for a maximum period of three years and a life-of-grant amount not to exceed $75,000. During the first two years of the contract grant program, the project will make two to three contract grants per year, so as to enable ISRA and the review committee to gain experience in reviewing and approving collaborative contract grant applications, monitoring implementation and coordinating the activities within their overall research program. In subsequent years, the number of contract grants will increase to five. In exceptional circumstances, where the collaborative NGO or extension agency is bringing extensive experience, technical expertise, and its own matching resources to the effort, the contract grant may be much larger. It is anticipated that the project will approve as many as five major contract grants, up to $300,000 each, over the life of the project.

The collaborative research contracts will be detailed and unambiguous protocols which state clearly the resources to be contributed by each party, their obligations and responsibilities, including their roles in selection of farmers, research interventions, implementation, monitoring, data collection, analysis and training of staff, if any. Past experience in Senegal and elsewhere has shown that successful collaboration requires clearly spelling out the resources that each party is to bring to the collaborative research effort.

The technical assistance contractor will release funds for the grants in accordance with the terms of the contract agreement with a portion stipulated for start-up (mobilization) costs and the balance disbursed upon satisfactory achievement of the milestones agreed upon in the research contract grant. The review committee, aided by the technical assistance team, will review progress under the contract grant at the end of the first year. Based upon this ISRA review and the review conducted by the "client" group, including their provision of matching resources, second-year funds will be released. The committee will conduct a similar review at the end of the second year. In exceptional cases, a research contract grant may be made for four years, however, any research contract grants for social science research will generally be limited to two years.

The research contract grants program will be announced each November, allowing at least six weeks for organizations to prepare proposals for submission before the end of January. The review committee will review proposals and select applicants by the end of February, no later than 30 days after the closing date for

submission. Proposals should identify the problem, describe its relationship to natural resources management and detail the required research work requested from ISRA's, where the research will be conducted, resources required, contributions from the applying institution or organization, expected results, duration and costs.

The review committee will judge proposals by two principal criteria:

- Relevance of the research proposed to the development, promotion and transfer of natural resources-based technologies, farmers, women as well as men. This includes socio-economic analysis of natural resources-based farmer strategies, policies and technologies which affect natural resources management;

- Capacity and commitment of the applicant to implement the proposed program, including the financial and human resources available to the collaborative effort, and emphasis upon integrating women in agriculture and natural resources development.

The research contract grant will be subject to outside audit as deemed necessary in a format approved by ISRA and the technical advisor. ISRA will submit progress reports under the terms of the research contract; collaborating organizations will be required to report annually as well. A system for managing the research contract grant program, administration and financial control, will be established by the research grants coordinator hired under the Title XII/ private sector contract technical assistance team. It is hoped that this innovative system of contracting for specific research will serve as a model for other donors and be an activity which ISRA could manage on its own after year five of the NRBAR project.

ISRA will invite representatives of collaborating agencies, institutions or organizations to its annual research program reviews. It will provide training for the staff of its research partners in areas relevant to the program and to the subject matter specialists and field supervisors working on the unified national extension system and for regional development agencies. Recognizing the comparative advantage of NGOs in working with village groups, ISRA will integrate NGOs into programs requiring group and community action. Finally, ISRA will keep extension agencies and NGOs informed through technical bulletins, fiches techniques, in simple and easily understandable language.

B. Grants to ISRA Researchers

The project will make three types of grants available to ISRA researchers. The first provides funding for researchers already engaged in natural resources-based research but needing assistance beyond that already available in ISRA's program. A second offers grants to researchers interested in natural resources technologies outside Senegal. A third, to be initiated after year three of the project, will provide sabbaticals for ISRA researchers to review and

deepen material developed and draw up findings from the first phase of the project.

Grants for research in Senegal: A number of ISRA researchers are already involved in natural resources-based research but need supplementary funding to maximize the impact of their work. For example, successful work on agroforestry in Senegal Orientale could be expanded with limited additional resources for transportation of researchers. A cropping systems study lacks a socio-economist to complete the team. A limited grants program will allow ISRA researchers to hire additional, short-term technical staff, cover operating costs, or get additional commodities required to complement their activities. The grants will not exceed $10,000 per year and will be limited to three years. Up to three grants annually will be available during each year of the project.

Site studies: A number of natural resources approaches and interventions are being tried elsewhere in the Sahel and in other countries in Asia and Africa. ISRA researchers can benefit from deeper exposure to these activities through short-term training, seminars and conferences. The project will provide funds for ISRA researchers to identify technical problems, travel to selected locations, spend up to four weeks studying the problem identified, approaches and methodologies tested, results obtained and impact to date.

The grants program will provide up to three grants per year during the life of the project. Possible locations include Niger, Burkina Faso, Mali, western Nigeria, Botswana, India's National Dryland Farming Research Project, and northern Thailand for soil conservation and water management. Careful advance planning with the host institutions will permit well-targeted focus on specific research activities. The technical assistance team will identify appropriate locations and facilitate the program.

Sabbaticals: From year three of the project, the project will offer up to two, three-to-four month sabbaticals per year to enable researchers to participate in research at a different research institution and to analyze and synthesize the longitudinal information developed under the project. Those eligible for sabbaticals will have participated as principal researchers for at least three years and have sufficient longitudinal data for synthesis and analysis. The technical assistance contractor will identify and negotiate with an appropriate host institution in the US, with advanced programs such as those in Morocco, Cameroon, India, Nigeria, or at an institution such as the International Institute for Tropical Agriculture (IITA), the International Center for Research in the Semi-Arid Tropics, (ICRISAT), the West African Rice Development Authority (WARDA), International Center for Research on Agro-Forestry (ICRAF), International Livestock Center for Africa (ILCA), or other institution as may be appropriate. The institution should have an international interest and agree to receive the researcher and provide a collaborator, office space and secretarial help thus incurring minimum cost to the NRBAR project.

ISRA and the contractor will work together to define the criteria and conditions for ISRA's in-house grants program and will publicize the program among its researchers. ISRA's internal research grants committee, composed of the Director of Scientific Research, Director of Production and a member of the technical assistance team, together with two outside representatives, will select participants in the program. The technical assistance team will be responsible for disbursement of the grants and for putting in place a system for tracking the use of funds.

2. Support for ISRA's Natural Resources Program

The project also provides $1,000,000 in support for ISRA's natural resources-based agricultural research program. The funds will be allocated based on a review of ISRA's core funding, funds available from other donors, and priorities established for natural resources-based research in ISRA's annual program review. The technical assistance team will review priorities with ISRA and authorize funds as appropriate. The natural resources-based research program, once established, will be reviewed annually by outside experts sitting with ISRA and the technical assistance team. They will review past results and comment on future priorities to be included in the natural resources program. The program will then be finalized by ISRA with the assistance of the technical advisory team and submitted as part of ISRA's overall research program to ISRA's governing board. Annual reimbursement to ISRA will be made on the basis of: the availability of a predetermined and Mission approved ISRA indirect cost rate, and the availability of ISRA certified financial statements for the periods for which reimbursement is sought.

3. Linkages to Regional and International Research Institutions

The project will set aside $500,000 to cover the costs of organizing and participating in seminars, conferences, workshops and exchange visits between ISRA staff and the staff of regional and international research organizations and, in particular cases, to finance operating costs of joint research. The objective is to enable ISRA: (a) to take advantage of research conducted elsewhere which has direct relevance to Senegal; (b) to increase the cost effectiveness of ISRA's research by reducing the need for ISRA to spend time on less tractable, long-term problems such as breeding for a striga resistant and drought tolerant, high yielding variety of millet, peanut varieties resistant to leaf spot, and rice resistant to blast; (c) to establish long-term linkages with international agricultural research centers which facilitate peer interaction and exchange.

Historically, ISRA has maintained linkages with four groups of research institutions:

- International agricultural research centers (IARCS): International Crop Research Institute for Semi-arid Tropics (ICRISAT), International Institute of Tropical Agriculture (IITA), West Africa Rice Development Association (WARDA),

International Livestock Center for Africa (ILCA), International Center for Research on Agroforestry (ICRAF), International Service for National Agricultural Research (ISNAR) International Potato Center, (CIP), International Rice Research Institute (IRRI), International Laboratory for Research on Animal Diseases (ILRAD).

- Regional research networks: Semi-arid and Food Grain Research and Development (SAFGRAD) in sorghum, cowpeas and maize, ICRISAT's millet network,(CORAF).

- Donor institutions: Food and Agriculture Organization (FAO), (CIRAD), USAID, and through the donor institutions, technical assistance institutions such as Title XII institutions and other consortia.

- Collaborative research support programs (CRSPs): (INTSORMIL, peanuts, bean-cowpeas.

Conferences, seminars and exchange visits: These relationships provide valuable resources to members in the form of short-term training, regional and international conferences and workshops, improved germ plasm, operating costs for joint testing and experimentation, and information exchange. Generally short-term, these resources have proved critical at ISRA during its years of financial crisis by allowing it to maintain a minimum level of activity in key areas despite shortages of funds. At the same time, although they provide professional impetus to individual researchers, activities sponsored by these linkages may not fit ISRA's own research priorities and plans. In providing funds for exchange travel by ISRA scientists and their peers elsewhere, conferences, and seminars, the project will ensure that joint research activities match ISRA's strategic priorities and are rationalized to minimize ISRA's management burden and that incoming resources are properly budgeted and accounted for.

Matching funds to encourage joint activities will deepen ISRA's experience in key areas, in soil-related technologies, improved germ plasm for cereals-based production systems, and agroforestry, for example. They will support ISRA's participation in INTSORMIL's work on beans and cowpeas, ICRA's research on agroforestry, ICRISAT's experimentation with millet, and WARDA's program on rice. The soil management CRSP, not currently active in Senegal, is another potentially important source of technical assistance for the project.

The linkages will provide ISRA with access to additional experience and resources; they will also permit ISRA to influence regional and international centers' long-term research agenda on subjects of importance to its own program. By coordinating research, inputs and resources through entities with overlapping strengths and resources, ISRA can strengthen its own program. For example, ICRISAT and INTSORMIL both work on millet, the bean-cowpea CRSP and IITA-SAFGRAD overlap. The technical assistance team will

help ISRA review annual plans from the international networks, as part of ISRA's annual review of its own program, to ensure a fit between ISRA's programs and network activities and avoid any disruption of ISRA's own agenda by externally generated research demands.

4. Technical Assistance

Technical assistance, both long and short-term, will help ISRA design and carry out a natural resources-based agricultural research program within its operating program. It will also strengthen ISRA's institutional capacity to plan, manage and carry out research.

Initially, the team will include four term long-advisors:

- Research manager: The research manager will work with ISRA's director to strengthen its planning and management systems. He will help ISRA redefine its five-year plan and establish a program matching its priorities against financial and human resource realities. He will advise ISRA on its reorganization and structuring and the process by which decisions are made, budgeted and carried out. He will advise on research and manpower planning and coordination of ISRA-wide departmental, station-level, on-farm and international linkage programs. He will assist in reviewing priorities, research methodology, dissemination of results and organization of periodic peer and program reviews.

- Natural resources planner: The natural resources planner will help ISRA develop a coherent strategy and program for natural resources-based agricultural research which fits into ISRA's long-term development strategy and plan. This person will help ISRA review existing natural resource technologies, available in Senegal or elsewhere, and establish a program to address priority natural resource management needs.

- Outreach advisor: The outreach advisor will work with ISRA to develop a system of protocols and grants with NGOs, farmers' organizations and extension agencies that permits farmer participation in assessment of needs, research priority setting, execution and validation. This person will help ISRA organize the outreach program, establish adequate procedures and monitoring systems, and as the project gets underway, work on field testing and adoption of technologies developed under the project.

- Financial advisor: The project will fund a financial advisor during the first three years of the project to work with ISRA on ensuring adequate financial systems are in place, increasing the effectiveness of the computerized accounting system, strengthening indirect cost accounting and generating timely financial analysis required by program-level and senior decision makers. This person will

help ISRA develop a system for tracking all donor and GOS contributions (see annex for scope of work). During the final three years of the project, a financial advisor will continue to assist ISRA on a periodic short-term basis.

- Project administrator: The project will hire locally a project administrator to be responsible for all logistical and administrative support required by the project team including housing rental, maintenance, guards, local procurement, clerical, secretarial and administrative personnel services. The administrator will be assisted by a secretary, also hired locally.

The project will budget for up to 140 months of additional short-term technical assistance. Additionally, USAID may "buy-in" to the Collaborative Research Support Projects (CRSP) which have activities underway in Senegal with ISRA. By directly linking with CRSPs, ISRA and the Mission can ensure that directly related research support, training, and technical assistance is provided. By working with the CRSPs, the Mission can ensure that valuable linkages developed over the last many years are maintained and strengthened. Illustrative areas for short-term technical assistance, in addition to financial management, include: agronomy, agroforestry, soil and water conservation and management, agricultural economics, sociology, economic anthropology, biometrics, research methodology and management and manpower development. The project will also fund short-term experts to review research related to the program. The collaborative review mechanism calls for up to four senior scientists from the United States or elsewhere to consult semi-annually with ISRA scientists, in January-February to discuss research findings and the next year's research program and in August-September to review research underway. Those experts participating in the collaborative review proces should serve on a sustained basis, through the life of the project.

5. Participant training

Long-term training: Based on an estimate of manpower requirements prepared by ISRA and the International Service for National Agricultural Research (ISNAR) in discussions during the past 18 months, and on independent appraisals of ISRA's needs for a natural resources-based agricultural research program, the project will fund 15 graduate degree programs in areas such as agroforestry, soil and water conservation and soil fertility. For example, ISRA has only two researchers trained in soil science and three in forestry. It has only one PhD sociologist. Balancing past attrition rates against future needs, shows that a mix of 5 PhDs and 10 masters during the life of the project is justified and reasonable given ISRA's current manpower levels. The disciplines include, illustratively, forestry, agronomy-crops, soils, soil and water management, rural sociology, natural resource economics, biometrics and statistics, agriculture engineering, agriculture extension-education.

Short-term training and conferences: The project will provide short-term training programs, often in-country, to promote collaboration with other researchers and to provide skills to address specific problem area in methodology or in natural resources management such as wind and water erosion, soil fertility, agroforestry and intercropping.

The project will also fund participation by farmers and representatives from organizations collaborating with ISRA on research, as well as ISRA scientists, in conferences, workshops and seminars, and on observation tours to visit natural resource management projects within or outside Senegal. The effort will be to build communication between ISRA and organizations and farmers participating in and using ISRA's research. ISRA researchers funded under the project for attendance at professional conferences will be expected to present a research paper.

Training and women: The project will make a particular effort to train female research technicians, scientists and research managers. The number of women at ISRA is limited. Of 558 employees, 58 are women, 32 of whom are secretaries. Seven of 115 researchers are women; six women are research assistants or superior technicians and four are administrative or accounting professionals. During the life of the project, an effort will be made to train at least two women to the PhD level and three women to the masters level. In addition the project will provide in-country training for up to ten women at the BS level, to compensate for the lack of women now qualified at this level who could be eligible for masters training.

The technical assistance team will be responsible for establishing with ISRA a program for selection of candidates and scheduling of appropriate training. All training will be guided by certain principles. It will aim at filling critical gaps in ISRA's staffing pattern with researchers who have a proven track record. It will target women. The program will also include research planning and management and financial management. Short-term training will be directed at specific areas, critical to the project focus and will not increase the numbers of ISRA researchers already participating in IARC training in crop production technologies and improvement. Short-term technical assistance will provide in-country training in areas with the potential for wide impact within ISRA such as computer training, technical analysis, rapid rural appraisal and experimental design. The project will not fund training in bio-technology and tissue culture program which require expensive facilities and impose high operating costs.

6. Commodities

The project will fund vehicles, computers, office and residential furniture, including appliances, for the technical assistance contract team. It will also provide a limited number of computers and vehicles and logistical support for GOS counterparts working directly on the natural resources program particularly in support of on-farm trials. USAID will be responsible for initial

procurement of commodities required by the technical assistance contract team. All commodity procurement subsequent to the arrival of the team will be handled by the team's chief of party.

Over the life of the project, a total of 11 vehicles will be purchased. Of these, five will be procured directly by USAID for the technical assistance team. Four of these vehicles will be four-wheel drive, the fifth will be a sedan. After the arrival of the technical assistance team, additional vehicle procurement will be initiated to ensure replacement vehicles and to procure one additional vehicle for ISRA's official fleet. Shortly after approval of the project, USAID ill initiate procurement of household furniture and appliances for each member of the technical assistance team. USAID will also directly procure ten personal computers (one each for the technical assistants and for their ISRA counterparts) and two laptop computers for the team and ISRA's use. The personal computers will be complete with uninterrupted power supply (UPS) units, and one printer/two computers. Additional office supplies and equipment will be procured upon arrival of the technical assistance team. USAID will procure office furniture (desks, chairs, filing cabinets, etc.) in time to coincide with the arrival of the technical assistance team. Any additional office furniture that may be required, and specific research-oriented commodities will be specified, approved by USAID and procured by the technical assistance team directly under their contract.

7. Audits and Evaluations:

The project will fund periodic financial compliance audits by an independent auditor to review financial procedures and assure that they are in compliance with GOS and AID regulations and are being accurately reported. Several locally based auditing firms are fully capable of preparing such audits of local currency expenditures. Audits of the overall Title XII joint-venture contract will be conducted in accordance with AID regulations. These audits will be supervised by the Regional Inspector General's Office for Audit in Dakar. For a discussion of project evaluations see Section VII, Evaluations.

III. Program Factors

A. Conformity with GOS Priorities

The New Agricultural Policy (1984) and the Cereals Plan (1986) set forth the Government's central concern for agricultural policy --increased food self--reliance, substituting domestically-produced cereals for imported rice. Donors have questioned the feasibility of the production targets and the wisdom of a strategy heavily biased toward a dramatic growth in irrigated rice production. Now engaged in an extended policy dialogue with donors, including the World Bank, the French, the European Economic Community, Germany and USAID, on a proposed Agricultural Structural Adjustment Loan, the GOS has recently proposed a new sectoral development policy. Still under discussion with the donors, this new policy statement includes these goals:

- A better distribution of income between rural and urban areas;
- A reduction of rural/urban migration;
- Balanced regional growth;
- Improved food security through increased production and consumption of local cereals, and;
- Better management of resources -- particularly soil -- with better integration of agriculture, forestry and livestock.

USAID's Natural Resources-Based Agricultural Research Project directly addresses the GOS's goals of "improved food security" and "better management of resources". The project, collaboratively designed with senior researchers and administrative staff from ISRA, directly relates to research priorities as expressed by ISRA.

The Cereals Plan remains valid as a general policy statement on cereals-related research policy. It clearly lays out the role of research to increase cereal production and emphasizes applied research to develop technical packages using appropriate varieties and inputs.[4] It proposes an emphasis on adaptive research on new varieties, taking advantage of work done elsewhere, and suggests that ISRA work closely with extension agencies on integration of farming and livestock systems, the use of compost and manure, and mixed cropping systems. It also emphasizes economic research on technical packages before dissemination. The proposed project will complement these objectives by providing a natural resources focus to achieve sustained cereal production increases.

B. Conformity with Africa Bureau's Strategy

The Natural Resources-Based Agricultural Research Project is consistent with the Africa Bureau's Plan for Supporting Agricultural Research and Faculties of Agriculture in Africa as modified in the 1989 addendum and with The Development Fund for Africa, An Action Plan in that it:

- supports agricultural research on sustainable natural resources-based technologies in Senegal, a technology-generating country for the Sahel;

- designates staple food crops--rainfed millet, sorghum, corn and rice--as the highest commodity research priority;

- seeks people-level impact through interdisciplinary, participatory research involving farmers and local organization;

- supports adaptive research by ISRA while relying on external networks for applied research on genetic materials, cultural practices and resources management technologies.

C. USAID/Senegal's Agricultural Assistance Strategy

USAID/Senegal's new development assistance strategy (CPSP, 1991) sets forth two strategic objectives for the primary sector: increasing crop productivity in zones with reliable rainfall and increasing the value of tree production.

The Mission's "Agricultural Sector Analysis" (1991) concluded that stagnant agricultural productivity is a key sectoral problem and that improved resources management--soil, water, vegetative cover --is essential to increase productivity and sustainability of agriculture, given Senegal's poor soils, extensive erosion and erratic rainfall. This strategy focuses on the southern portion of the country which has adequate rainfall, somewhat better soils, and contains most of Senegal's arable but uncultivated "frontier."

The proposed project begins what we envision as a 15-20 year commitment to improve natural resources management in Senegal. It will work with ISRA to generate productivity-enhancing, regenerative technologies. At the same time, the Reforestation Project and a planned natural resources management project will continue to encourage widespread tree planting. Finally the Southern Zone Water Management Project will seek to increase rice production in the Casamance through land reclamation (from salinization) and increased water availability. ISRA-generated appropriate technologies to manage these soils, improved water utilization, adapted varieties, and better agronomic practices are all important ingredients for realizing the potential production increases sought by USAID through these projects.

D. Other Donor Experience

Donor support continues to be critical to ISRA's research program. Collectively, through project aid, donors have funded virtually all of ISRA's research program expenses, exclusive of salaries, and during the next two years, more than half of ISRA's financing will come from donors. Traditionally, France has been the largest donor, providing almost 30 percent of total donor support, followed by the World Bank with 25 percent and USAID with 10 to 15 percent.

In general, donors have avoided overlapping interests. Each donor has focused on specific areas: the Canadians on fisheries; the Germans on maize; the French on peanuts, cotton, livestock, irrigated corn, horticulture and plant breeding; and USAID on agricultural economics and farming systems research.

Where donors have shared areas of mutual interest, they have collaborated. For example, the World Bank and USAID have coordinated closely on research policy, planning, and management. They have worked with other donors like the French in discussions with ISRA on reform, decentralization and restructuring. The impact of these discussions is reflected in ISRA's major efforts at reorganization and reform, particularly in the last two years.

USAID and the World Bank continue to share an interest in research planning and financial management, and a portion of World Bank funds included in the recently negotiated, $18.5 million Second Agricultural Research Project has been set aside to help address these issues. The World Bank demonstrates its concern with ISRA's financial stability by including conditionality requiring the GOS to maintain funding for ISRA at about $5.9 million annually and by wide-ranging budget support to cover operational and capital costs.

The Bank views itself as a funder of last resort to ISRA, providing generalized budget support and picking up research activities not already funded by other donors. Therefore, its project, which began in 1991, is complementary to ours, but its purpose is considerably broader, and where it covers the same ground as the USAID project, it does so comparatively thinly. For example, while our project concentrates on natural resources-based research, the Bank project includes: support for construction of a Dakar headquarters and other civil works ($2.1 million); equipment and vehicles ($4.5 million), research projects already included in ISRA's five-year plan ($7.3 million); and a reserve fund for projects not yet identified ($1 million). It funds research on farming systems and mechanization, water management and fertilization, fisheries, horticulture, cotton and livestock. There is also limited support for agroforestry and soil conservation.

Demonstrating its shared interest with USAID in natural resources, the Bank has proposed a new natural resources management program under its project and provided $1 million to support four researchers, technicians, vehicles, per diem and staff to work on nine research sites throughout the country. In a May 1991 meeting with USAID, World Bank official, Andrew Spearling, said, however, that the Bank would let USAID take the lead in natural resources research and would use its project to fill gaps outside USAID's project zone.

The World Bank is also active in extension. Its $17.1 million extension project seeks to build a unified national extension service modeled on the training and visit (T&V) approach. It has been working with regional development authorities to establish a program of regular extension visits and training, an integral link to ISRA, and farmer-oriented technical materials. Funds are provided under the project for on-farm research trials in collaboration with ISRA and the government agencies involved in extension.

The USAID program complements the Bank's research project by providing substantial new funding for natural resources-based technologies and technical assistance to help shape the program. It will also serve as a useful parallel to the Bank's work with the formal extension network by encouraging a research-extension-research network incorporating non-governmental organizations not covered in the World Bank's extension project.

As pointed out in the institutional analysis, ISRA's donors need to improve their coordination. No donor coordination meeting has been held since early 1988. Although the World Bank views itself as the lead donor and responsible for coordination, the reality is that no one at the World Bank's representational office in Dakar focuses exclusively on agricultural research. Coordination with ISRA's major donors, including France (CIRAD, ORSTOM, Caisse Centrale), the European Community (CEE, FED), Canada (IDRC) and the World Bank, is done only on a case-by-case basis, despite donor awareness of the need for better overall coordination.

The Special Program for African Agricultural Research (SPAAR), created under the auspices of the World Bank, focuses on coordinating donor assistance to research and could lessen current problems from disparate aid programs. SPAAR proposes a mechanism for consolidating research funding, providing incentives for quality planning and research and ensuring sufficient funds for overhead. The initiative also assumes that national institutions will improve their own institutional capacity and suggests that future aid decisions may be based on weighing comparative advantages of various African research institutions in undertaking specific types of research.

The SPAAR initiative holds promise, but may take some time to develop. ISRA's donor community, while waiting, needs to give greater attention to coordination, and the technical assistance team will play an important role in encouraging communication between donors.

IV. Cost Estimates and Financial Plan

A. Introduction

The Natural Resources-based Agricultural Research Project is a seven-year project with a total cost of $19.75 million using Development Fund for Africa (DFA) resources. The Mission plans to obligate $4 in FY 91 from the Development Fund for Africa, with the remainder funded incrementally over the next five years.

B. Budget Summary

The project's budget summary appears in Table I. Table II gives a detailed breakdown by cost item of the project's elements, including number of person-months and timing of technical assistance, training, commodities and sub-grants during the life of the project. Table III shows methods of implementation and financing.

C. Disbursement Plan

Funding for the $19.75 million project will be obligated over a seven-year period, beginning with $4 million in 1991. AID will negotiate a direct-payment, joint contract to provide for technical assistance and other project implementation actions such as training, commodities, and subgrants. These services will be paid only on a cost-reimbursement basis; advance funds may be permitted for other project implementation actions. The management and accounting of the local currency account which funds the research support costs and the ISRA's NRP grant will be set forth in a Project Implementation Letter (PIL); the provisions of the PIL will be included in the operations manual to be developed by the contract technical assistance team. It is anticipated that the disbursements for the research support costs will be made by the contractor directly to the grantees or their suppliers and for the ISRA NRP grant costs by the contractor to ISRA. USAID is exploring the utilization of a modified fixed amount reimbursement for the collaborative research contracts. USAID/Dakar will seek additional guidance from Washington on the modified F.A.R. for this purpose. If acceptable, details will be spelled out in a PIL.

USAID will contract with a local financial management firm to provide services on a cost reimbursement basis during the pre-implementation phase. Depending on the financial capacity of the selected contractor, the mission may choose to authorize advance payments for the program costs only, such as training, excluding the services of the contractor.

USAID will make direct payment reimbursements to suppliers for commodities (vehicles, office equipment, furniture) purchased directly by USAID/SMO.

For procurement through a PSA, AID will issue a direct letter of commitment, prepared by SMO for the USAID controller's approval for payment of commodities and direct payment will be made for the services of the selected PSA.

AID will also make a direct payment for the procurement of services for a USAID project officer and for audits and evaluations.

D. Financial Control

Accurate financial controls and reporting on all grants/contracts and local currency expenditures to USAID and to the GOS will be the responsibility of the contractor. The USAID Controller will review the accounting system set up by the contractor for the local currency account. The contractor will submit reconciled expenditure reports, compared to annual budgets and to the total life of contract, to the USAID project officer and to the GOS quarterly; the format and content of these financial reports will be described in a Project Implementation Letter (PIL). Not less than three months after arrival of the contract technical assistance team, the contractor will submit for ISRA's review and USAID's approval its first annual workplan and budget. Not later than six months after the arrival of the technical assistance team, the contractor will develop for AID review and approval a project operations manual for the local currency account. A critical area to be addressed in the operations manual will be the funding mechanism for the ISRA grants or contracts which will be signed. The mechanism for funding these grants or contracts will be developed collaboratively with ISRA and USAID. The mechanism will be structured so that disbursements will be made to ISRA grantees directly by the contractor (e.g. letters of commitment may be issued against grants by the contractor or the grants themselves may be cleared by the contractor to commit the project).

Annual Host Country Contributions*

		Amount
1. Salaries and Benefits		330,000
GOS Researchers	90,000	
GOS Research Assistant	80,000	
Administrative Clerical Personnel	75,000	
Station Personnel	85,000	
2. Infrastructure		40,000
Headquarters	10,000	
Research Stations	30,000	
3. Operation Costs		100,000
(telephone, electricity, water, maintenance, etc.)		
4. Land		30,000
TOTAL		$500,000

* These figures represent in-kind contributions.

TABLE I

Budget Summary

	Costs $000's	
Title XII		
1. Research support		3,470
a. Collaborative grants (26@ $25,000)	$650	
(5@ $300,000)	1,500	
b. ISRA researcher grants		
(1) Research in Senegal (18 x $30.000)	540	
(2) Site visits (18 x $10,000)	180	
(3) Sabbaticals (8 X $75,000)	600	
2. Support for ISRA's Natural Resources Program		1,000
3. International linkages		500
a. Conferences, Seminars, Exchange visits	250	
b. Operating costs for joint-programs (10 X 25,000)	250	
4. Technical Assistance		8,190
Long-term advisors (3 X 6 years, 1 X 3 years, @ $225,000)	4,725	
Short-term advisors (140 months X $20,000)	2,800	
Local support staff (administrator, secretary)	450	
Home office support (1/4 time X 6 yrs adm and secretary)	215	
5. Participant Training		,315
L-T .5 graduate yrs @ 35,000	1,575	
S-T 35 programs @ $20,000	700	
B-S 10 programs @ $4,000	40	
6. Commodities		212
AID Direct Procurement		
1. Pre-implementation studies and training		550
a) Financial Management controls	300	
b) Technology Inventory	150	
c) Training	100	
Commodities		317
3. USAID Project Assistant years @$50,000)		350
4. Evaluation and Monitori..		525
5. Audits (3@ $55,000)		165
6. Inflation		1,759
7. Contingency		397
TOTAL		19,750

TABLE II

LIFE OF PROJECT METHODS OF IMPLEMENTATION AND FINANCING

Method of Implementation	Method of Financing	Approximate amount ($000s)
Contract with Title XII University and Partners to provide TA, training, commodities, equipment, sub-grants, local hire salaries, home office support, audits, G & A.	Direct Payment	15,687
Contracts with local firms or individuals to provide pre-implementation services and studies, local English language training, pre-implementation workshops.	Direct Payment (Purchase orders)	550
AID direct procurement of furniture and vehicles	Bank/Direct Lcoms and Direct Payment (Purchase orders)	317
USAID Project Officer	Direct payment	350
Audits, monitoring and evaluations	Direct Payment, PSCs or purchase orders.	690
Contingency & Inflation	To be determined	2,156
		19,750

V. IMPLEMENTATION PLAN

A. Introduction

The implementation plan sets forth the responsibilities of the key participants in the Natural Resources-Based Agricultural Research Project. It describes the methods of contracting for goods and services, establishes a procurement plan and sets out a timetable for implementation of activities under the project.

Design of the project has included close collaboration between USAID and ISRA. Successful implementation will need to continue that collaboration. The implementation plan is designed to ensure communication between USAID, ISRA and the technical assistance team and among donors and private organizations working with ISRA on agricultural research or in related areas such as extension.

B. Contracting and Gray Amendment Considerations

The project will be implemented through a technical assistance team hired under an AID direct contract. AID will use Title XII procedures to select the contract team. Criteria for selection under Title XII will include:

- o composition of a joint team drawing not only from Title XII institutions but also from private companies and voluntary organizations with experience and demonstrated ability in advising a national agricultural research institution in research and financial management and in natural resources research;
- o experience in working with private voluntary organizations, private companies, government and non-governmental extension agencies, and farmers in a participatory agricultural research program and in gender analysis;
- o substantial subcontracting with Gray Amendment entities.

In accordance with AID regulations and under Title XII of the Foreign Assistance Act, USAID will contract to provide technical assistance, procurement and training. In addition to the long-term contractor hired under Title XII, USAID will select through free and open competition a contractor or contractors during the pre-implementation phase to do an inventory of natural resources-based technologies now being used in Senegal and to provide technical assistance in financial management and internal control systems to ISRA. During the pre-implementation phase USAID will also arrange procurement of commodities and vehicles required immediately by the contract team.

Competition among offerors under Title XII procedures will allow for participation of Gray Amendment sources as the prime contractor, sub-contractor or consortium member. According to AIDAR 752.226-2 (Feb 1990) no less than ten percent of the total contract amount including the grants program must be subcontracted to economically and socially disadvantaged enterprises, historically Black colleges and universities, and PVOs controlled by socially and economically disadvantaged individuals.

The CBD notice and instructions to offerors will make explicit the requirement that at least ten percent of the contract amount must be contracted to a Gray Amendment entity and that all selection evaluation criteria being found equal, the extent of participation of such concerns will become a determining factor for selection.

C. Responsibilities

1. USAID

USAID/Dakar will designate the Chief, Agricultural Research Division, as the USAID Project Officer. The Project Officer will be assisted by one operating expense (OE)-funded secretary and one project-funded assistant project officer. The OE-funded Agricultural Research Division secretary will provide required support services. The Project Officer will be responsible for AID approval, guidance and general monitoring of the contracts. S/He will be responsible for advancing project objectives and keeping implementation on schedule. The Project Officer will be supported by a Mission Project Committee which may be convened at anytime to examine specific problems. The Project Officer will draft the terms of reference for the Title XII/joint venture technical assistance contract. The Project officer will also arrange for initial commodity procurement, audits, and evaluations, and be responsible for the pre-contract initiation of the training plan. In addition, the Project Officer will supervise an AID Direct Contract for monitoring and evaluation of project activities and project goal achievements. The USAID Project Officer will undertake the following tasks on behalf of AID:

1. Maintain frequent contact with the Chief of Party and other members of the Technical Assistant Team and GOS officials at ISRA in order to implement and manage the project.

2. Organize a pre-implementation orientation seminar for AID, ISRA, and donors and other participants, to discuss the project elements and implementation of the project.

3. Participate in periodic visits to project sites and project activities (e.g. workshops) to assess progress toward achievement of project objectives. The visits will be summarized in trip reports.

4. Analyze and approve various project implementation actions which require prior AID approval.

5. Review documents submitted by the GOS to meet the project's conditions precedent in cooperation with the USAID Legal Advisor. Monitor the implementation of various actions desired under the project's covenants and conditions.

6. Review and approve the project's annual workplan that defines the activities, with distinct timetables, to be accomplished by the contractors.

7. Review quarterly or semi-annual project progress reports prepared and submitted by the technical assistance contractor's COP. The original reports and two copies of each will be submitted on a quarterly or semi-annual basis established after the implementation team arrival on site.

8. Arrange for and review the periodic audit reports of the project's financial and implementation status as performed by local public accounting firms under direct contract with AID.

9. Review monthly project reimbursement vouchers submitted by the project's contractors to AID for reimbursement of official project expenses.

10. Prepare the evaluation scopes of work and draft a project implementation order for technical services (PIO/T) for the evaluation team.

11. Arrange for an AID Direct Contract for evaluation and monitoring of project activities and achievement of project objectives and supervise the evaluation process.

12. Participate in the annual USAID in-house reviews of the project's major components as well as participate in the joint project reviews with the GOS.

13. Prepare an agenda and chair the periodic USAID Project Committee meetings as needed to facilitate project implementation.

14. Arrange, as necessary, for a pre-implementation Contractor (or contractors) who will assist in initial USAID direct procurement (commodities and the technology inventory study, for example) not included under the prime AID Direct Contract for technical assistance.

15. Develop the scope of work for the technology inventory so as to include baseline indicators for project monitoring.

16. Draw up the scope of work and arrange for an AID-direct contract with a local firm to advise ISRA on financial management and internal control systems, and provide financial management services to ISRA, prior to the arrival of the long-term technical assistance team.

17. Draw up the scope of work and arrange for an direct contract for an inventory of natural resources-based technologies to be carried out pre-implementation.

18. Arrange regular, periodic meetings between donors involved in agriculture research and extension to discuss project related developments and engage in joint planning.

19. Ensure that all project documents comply with A.I.D. and USAID/Dakar policy for integrating women into development (e.g., participation data by gender, gender considerations discussed in reports, gender disaggregation of data, gender analysis in scopes of work, etc.).

Government of Senegal

ISRA, on behalf of the Government of Senegal, will appoint and finance a project director and a deputy director. The project director will serve as the primary counterpart of the implementation team COP and be responsible for all project activities included and excluded of the AID Direct Contract for technical assistance. The ISRA project Director will also name principal collaborators to work with each long and short-term technical assistant.

In addition, ISRA will provide office space, field research facilities, and access to laboratories and computers, needed by the long-term technical assistance team and by short-term technical advisors.

ISRA will establish a farmer-participatory system for collaborating on the testing, validation and evaluation of technologies. ISRA will sign protocols with NGOs, farmers organizations, agricultural input suppliers or other non-traditional extension organizations, to test technologies on-farm and get results back to ISRA in order to enable farmers to inform ISRA of their problems and priorities and help ISRA to respond to them with new technologies. ISRA will also develop new technologies and work with the traditional extension service.

ISRA will sign protocols and will have ongoing programs with regional, international and other national research institutions centers for joint research, training and technical assistance addressing specific, practical issues, applied research involving soil conservation and moisture management and related production and marketing issues. ISRA will introduce a system of grants for individual research proposals in line with ISRA's programs which provide effective incentives for individual researchers. ISRA will organize interdisciplinary teams to carry out research on natural-resources-based technologies, provide counterparts for technical advisors, both short and long-term and designate counterparts from the applied economics group to work with the interdisciplinary teams and on the evaluation and monitoring component of the project and its technical assistance. ISRA will establish a program of annual workplan reviews and periodic meetings with extension agency representatives and client groups.

3. Technical Assistance Contractor

The technical assistance contractor will provide necessary inputs and action required for implementation as described in its contract. The contractor will provide all the technical assistance personnel (logistical, administrative and service related to housing rental, maintenance, guards, and necessary secretarial, clerical or administrative personnel), arrange all training, provide for procurement of specified project commodities, and contract local staff as required to implement the project.

The technical assistance team will be located in office space provided by ISRA and will receive additional logistical and research support as specified above. Developing detailed specifications in conjunction with ISRA, and procurement of commodities and equipment as well as the financial management and supervision of the grants program will also be a responsibility of the technical assistance contractor.

The Chief of Party (COP)/Research Planner of the technical assistance team will have primary responsibility for assuring the progress in achieving project objectives and goals as stated in the AID Direct Contract. The Chief of Party will be assisted in the management of the project by a quarter-time Campus Project Director from the lead university or by a representative of the US private organization. The Campus Project Director or representative of a US private organization will coordinate the project activities of the other participating universities or private firms through Project Coordinators. The Chief of Party, the Campus Project Director or a representative of the U.S. private organization, and other Coordinators will operate as a management team for contract implementation on the US side. The Chief of Party will have primary responsibility for in-country, day-to-day management and implementation of the contract. The Campus Coordinator will be responsible for stateside backstopping and implementation activities such as recruitment and nomination of technical assistance team members (long-term and short-term), orientation and language training, placement and monitoring and reporting of degree candidates, and the purchase and shipment of commodities acquired in the US, and backstopping of the small research grants activities. The chief of party will:

a. Meet regularly at least once a week with the GOS Project Director and USAID Project Officer, and/or with other members of the USAID, other donor community and with team members and representatives or contractors for this project.

b. Participate in periodic inspection visits to project sites to assess progress in the field toward achievement of project objectives. The inspection visits will be summarized and distributed in written trip reports prepared by the Chief of Party in collaboration with project team members and technical assistance long or short term.

c. Prepare project documents for various project implementation actions which require prior AID approval

before submission to GOS for analysis. The Chief of Party will assure that the project's activities are consistent with the project paper and the project's annual work plans prepared by technical assistance and are included in the AID Direct contract funded under the project. The first annual workplan will be submitted to USAID and ISRA within 60 days of the Chief of Party's arrival.

d. Assist with the determination that the implementation of various actions desired are acceptable under the project's covenants and conditionalities.

e. Formulate with the GOS project director the project's annual work plans which define the activities to be carried out by the respective parties under a distinct timetable and with maximum participation of farmers'organizations, NGOs, private enterprise.

f. Review the results from various studies to be undertaken by the contractors; and discuss in meetings with GOS counterparts.

g. Prepare and submit detailed quarterly project progress reports (one original and two copies) on time to USAID and GOS. The timing of the original report will be established after contractor's arrival on site.

h. Review and ensure implementation of the periodic audit reports of the project's financial and implementation status as performed by local public accounting firms under direct contract with AID and implement audit's recommendations.

i. Participate in the periodic USAID project committee meetings as needed to facilitate project implementation assessment.

j. Review progress of training participants long-term and short-term and discuss in meetings with GOS counterparts.

k. Review periodically commodities plan and inventory with counterparts. Make recommendations and follow up on implementation for control of fuel and maintenance and repairs of vehicles.

D. Implementation Schedule

Phasing of Project Implementation: The project's implementation has been divided into four phases: the pre-implementation, project start-up, project implementation, and project close-out.

The activities planned for each phase are described briefly below. A chart indicating the planned start and end dates for each phase is attached as an Annex to the Implementation Plan.

Pre-Implementation: (Months 0-12) During the pre-implementation phase, USAID and ISRA will sign the project agreement and work together to meet any conditions precedent to disbursement. Concurrently, together they will plan and conduct a pre-implementation workshop, begin preliminary identification of long-term training candidates, and continue close dialogue on the planning for technical assistance to be provided under direct AID contract, development of scopes of work, qualifications, signing a PIO/T, refining the terms of reference for the Request for Proposals, issuance and clearance of bid documents, and contract team selection. Other pre-implementation activities will include placement of participants into English language training if required, the execution of procurement documentation for logistical support to the contract technical assistance team, and the initiation of the socio-economic "impact study" (the "technology inventory") of existing traditional and adopted natural resources-based technologies in three regions of the country.

The single most important pre-implementation activity will be the execution of a competitively bid direct AID contract with a local accounting and financial management firm to assist ISRA in bringing up to date their financial records, complete outstanding audit actions, determine the personnel requirements and training needs for their administrative and financial management division, review the existing flow of financial documents and develop a comprehensive system for financial planning, budgeting, management and accounting and internal controls. In short, the objective of this first major pre-implementation action is to assist ISRA with its current financial crisis while developing and implementing an action plan to strengthen overall financial management and internal financial controls including the identification of commodities, technical assistance or training required.

Project Start-Up: (Months 13-24) Project start-up begins with the arrival of the contract technical assistance team. The team will work with ISRA staff to develop an annual financial and work plan that will include recommended actions from the financial and budget management review conducted during the previous phase and a procedures manual describing procedures for purchasing, accounting for, and managing local currency expenditures under the contract. ISRA and the team will make contacts with appropriate NGO's and private sector organizations to determine modalities of cooperation leading to the signing of protocols for collaboration in the development and testing of natural resources-based technologies at the farm level. The contract team and ISRA will jointly develop, submit for approval, and utilize an "operations manual" which will be used to guide all aspects of project operations. ISRA and the technical assistance team will determine the project commodity requirements for the project and initiate documentation to begin procurement of equipment and supplies required for years 2-7 of the project. Annual research plans and a monitoring plan will be developed and reviewed, rapid rural appraisal teams will begin work out of each of the cooperating research stations to do farmer needs assessments. The contractor team will establish baseline data for measuring project impact. Participant selection process will be

completed and participant training (both long and short-term) will begin.

The project start-up period will continue the dialogue process already underway with ISRA and will include the technical assistance team and increased donor collaboration through quarterly or semi-annual donor meetings. The contractor will help ISRA develop and negotiate agreements and protocols for grants to farmer groups, the private sector, or non-government organizations; he will assist ISRA develop selection criteria for directed grants and sabbaticals and organize observation trips for ISRA research scientists and staff collaborating and staff from organizations. USAID and the GOS will reach agreements on the transfer and use of local currency generated under the agricultural sector program and available to the project as host-country contribution, to cover natural resources-based research costs. During this project start-up phase, there may be required revisions and modifications to the project based upon a review of progress and reconsideration of the process of implementing an innovative, farmer-oriented research project aimed at natural resources-based technology generation and transfer. A mid-term project evaluation, to be conducted toward the end of this phase of the project, will assist in the re-formulation of approaches to the implementation of this project. The sabbatical program will begin at the end of year three of the project.

Project Implementation: (Months 25-77) This phase will include on-going monitoring and implementation of approved annual workplans, donor coordination meetings, annual reviews of research plans and research results, contract audits, procurement of additional or replacement commodities, and the signing of additional protocols with NGO's, farmer groups, or private sector.

Phase Down: (Months 78-84) Phase down operations will begin the last six months of the project. The activities to be undertaken will include the accelerated transfer to ISRA of any remaining responsibilities for financial management, and the transfer of project-financed commodities to the GOS. A final overall dollar and local currency audit will be done in accordance with AID regulations after contract termination. A final evaluation will be conducted to assess the project's contribution to the strengthening of ISRA as an organization as well as to measure the extent to which the project achieved desired results in terms of increased income and cereal crops production through the improved management of natural resources. USAID will prepare a project assistance completion report (PACR) will be submitted.

The following activities have been identified by project phase. Annex J, provides additional details on activities, sequencing and proposed timing of each of the four project phases.

Pre-implementation: (Month 0-12)

1. Project Paper Authorized
2. Grant Agreement Signed
3. PIO/T for technical assistance signed; PIO/C for initial commodities (furniture, appliances, vehicles, etc.) signed.
4. Pre-implementation workshop (ISRA, USAID, NGO's, extension agents) Held
5. Draft RFP circulated.
6. Commerce Business Daily Advertisement Placed
7. RFPs issued
8. Responses reviewed and contractor selection process initiated
9. English language training for long term training candidates begins
10. PIO/Ps drafted
11. Natural resources technology inventory and socio-economic impact study begins work on identifying two technologies in each of three zones
12. Contract financial management/accounting team begins work
13. TA team selected and contract negotiations begin.

Project Start-Up: (Months 13-24)

1. TA team arrives.
2. ISRA/TA team develop annual workplan, budget, and initiate baseline studies.
3. Final participants selected and placement begins.
4. Annual donor coordination meetings begin.
5. Annual research plans submitted and reviewed.
6. TA team submits Operations Manual for USAID review and approval.
7. Short-term technical assistance plans developed and short-term T.A. begins.
8. ISRA begins inter-disciplinary research work.
9. Joint protocols with three NGO's signed.
10. First sabbatical and study program grantees selected at the end of year three.
11. Study visits to neighboring countries, IARC's, etc begin.
12. First tranche of local currency support provided.
13. Procurement of first lot of project commodities (vehicles, computers, office equipment) completed.
14. PIO/T for mid-term evaluation signed.

Implementation: (Months 25-77)

1. Mid-term evaluation conducted.
2. Evaluation recommendations discussed and revisions to planning made.
3. Non-federal audit program begins.
4. Annual workplans submitted and approved.
5. Donor coordination meetings continue.

5.

6. Seminars on natural resources management research conducted annually
7. Participants return.

Project Close-out: (Months 78-84)

1. Develop scope of work for final non-federal audit.
2. Develop commodity list and initiate transfer of property.
3. Develop plan for repatriation of contract TA employees.
4. Sign PIO/T for final evaluation.
5. Draft PACR.
6. Ensure submission of bills for goods and services.

54

COMMODITY PROCUREMENT PLAN (ESTIMATED)

Commodity	Qty Ordered	Unit Cost	Commod. Cost	Mark-up 4%	Inland Trans Insur.10%	Freight 45%	Cont/Local Charges 15%	Tot.Est. Costs	Resp. Agency	Procur. Source/ Origin	Method of Proc.	Sched.of Proc. Order Issued	Del. Time	Arrive.	Consig-nee
1. Office Furniture															
Staff desks	8	$330	$2,640	$106	$264	$1,188	$396	$4,594	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Sec. desks	2	422	844	34	84	380	127	1,469	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Desk chairs	10	215	2,150	86	215	968	323	3,741	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Conf chairs	10	50	500	20	50	225	75	870	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Conf table	1	188	188	8	19	85	28	327	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Bookshelves	8	100	800	32	80	360	120	1,392	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Filing Cab.	10	183	1,830	73	183	824	275	3,184	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Storage shelves	10	145	1,450	58	145	653	218	2,523	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Comp. tables	4	189	756	30	76	340	113	1,315	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
2. Office Equipment															
Microcomp.	10	3,000	30,000	1,200	3,000	13,500	4,500	52,200	USAID	U.S.	Direct USAID	Oct 91	1 mo.	Jan 92	Proj
Laptops	2	3,500	7,000	280	700	3,150	1,050	12,180	USAID	U.S.	Direct USAID	Oct 91	1 mo.	Jan 92	Proj
Printers	5	760	3,800	152	380	1,710	570	6,612	USAID	U.S.	Direct USAID	Oct 91	1 mo.	Jan 92	Proj
Power supply units	10	430	4,300	172	430	1,935	645	7,482	Proj	935	CONT Direct	Oct 91	1 mo.	Jan 92	Proj
Photocopier	3	6,667	20,001	800	2,000	9,000	3,000	34,802	Proj	935	CONT Direct	Oct 91	1 mo.	Jan 92	Proj
Electric typewriter	1	1,404	1,404	56	140	632	211	2,443	Proj	935	CONT Direct	Oct 91	1 mo.	Jan 92	Proj
FAX machine	3	2,175	6,525	261	653	2,936	979	11,354	Proj	935	CONT Direct	Oct 91	1 mo.	Jan 92	Proj
Telephone equivalent		1,000	1,000	N/A	N/A	N/A	N/A	1,000	Proj	935	CONT Direct	Oct 91	1 mo.	Jan 92	Proj
Slide projec.	1	1,790	1,790	72	179	806	269	3,115	Proj	935	CONT Direct	Oct 91	1 mo.	Jan 92	Proj
3. Office Supplies															
Stationary & Supplies		N/A	16,800	N/A	N/A	N/A	N/A	16,800	Proj	Local	CONT Direct	LOP			
Accessories, paper, toner for photo-copier		N/A	12,600	N/A	N/A	N/A	N/A	12,600	Proj	Local	CONT Direct	LOP			
4. Vehicles															
-Initial proc.															
4WD vehicles	4	23,000	92,000	N/A	N/A	N/A	N/A	92,000	USAID	935	Direct USAID	Oct 91	3 mo.	Jan 92	USAID
Sedans	1	15,000	15,000	N/A	N/A	N/A	N/A	15,000	USAID	935	Direct USAID	Oct 91	3 mo.	Jan 92	USAID
-Replacement vehicles															
4WD vehicles	4	23,000	92,000	N/A	N/A	N/A	N/A	92,000	Proj	935	CONT Direct	Oct 94	3 mo.	Jan 95	Proj
Sedans	2	15,000	30,000	N/A	N/A	N/A	N/A	30,000	Proj	935	CONT Direct	Jan 95	3 mo.	Mar 95	Proj
5. Household Furniture															
Set for 4 LT TA	4	13,500	54,000	2,160	5,400	24,300	8,100	93,960	USAID	U.S.	Direct USAID	Oct 91	5 mo.	Jan 92	USAID
Appliances X 4		3,200	12,800	512	1,280	5,760	1,920	22,272							
Warehousing		3,000	3,000					3,000							
TOTAL			415,178	6,111	15,278	69,065	23,022	529,235							

OF WHICH:
-USAID Initial Procurement: $314,239
-Contractor Procurement over LOP: $211,996

USAID will be initial consignee but will hand over title to equipment & vehicles to host contractor when the Chief of Party is assigned.

BEST AVAILABLE DOCUMENT

SUMMARY OF TECHNICAL ASSISTANCE

		No.	P/M	Dollars (000's)
1.	Long-Term T.A.			
A.	Research Manager	1	72	1350
B.	Natural Resources	1	72	1350
C.	Research Grants Advisor	1	72	1350
D.	Financial Advisor	1	36	680
2.	Short-Term T.A.	-	140	2800
3.	Pre-Implementation			
A.	Financial Management	-	12	300
B.	Technology inventory	-	12	150
C.	Training (language)	-	12	100
4.	Audits	3	10	165
5.	Evaluation	2	10	275
6.	Measurement (indicators/baseline)	-	17	250

VI. Summaries of Project Analysis

A. Technical Analysis

The area south of the 400mm rainfall isohyet designated for this project is Senegal's major hope for sustainable growth in agriculture. About 80 percent of the moderate-potential land, excluding reserves, and almost all of the unexploited land lies in this zone.

The zone represents an area of comparative advantage for certain crops such as millet, sorghum, maize, cotton, peanuts, and, in the Casamance, rice. Given the press of population to the north and the widening gap between production and consumption needs, these resources will clearly have to be brought into production relatively soon. The advantage is that these lands are located in an area with sufficient rainfall for most cereal crops. The disadvantage is that most of these soils are extremely susceptible to erosion once the vegetative cover is removed. Farming, as practiced in most of the country, contributes to this erosion by stripping virtually all crop material from the soil. The organic matter content of Senegal's soils drops rapidly once the vegetative cover is removed reducing productive capacity, cutting water retention, lowering response to inputs such as fertilizer and increasing vulnerability to even marginal changes in the weather. During the 1970's soil productivity declined an estimated 3-5 percent in the Peanut Basin, and any newly opened land risks the same fate.

This does not mean that there are not possibilities for increased productivity. The technology review for the Agricultural Sector Analysis found soil and water management techniques that could add between 30 and 180 percent to millet and sorghum yields. Proper use of complementary techniques that are suited to local conditions can increase yields of rainfed rice, maize and sorghum 50 to 100 percent. Acacia albida, pulls soil nutrients from deep soil and increases organic matter; it is reported to increase groundnut yields as much as 40 percent and millet yields 150 percent.

The solutions do not necessarily mean higher cash expenditures by farmers, but instead offer better efforts to test and demonstrate the benefits of good resource management to farmers. Based on a technical review of the problems and potential in the project's zone of intervention, the project will focus on three priority research themes: soil fertility, water management, and farming systems, including land use, cultivation techniques and livestock management.

The themes will be studied across the three regions, the South-central Peanut Basin, Senegal Orientale and Haute Casamance, Basse Casamance, and in each region, research activities will be designed to address local conditions. The Peanut Basin suffers from declining rainfall, degradation of natural vegetation, fragile soils vulnerable to wind erosion, population pressures and over-exploitation of natural resources, an inbalance between trees, crops and livestock systems with declining forests and woody plants. Senegal Orientale and Haute Casamance face some of the same

problems, reduced rainfall, population pressures leading to infrequent fallow and overuse of forest and tree reserves. Upland oils are shallow and vulnerable to water erosion. Lack of vegetation and low organic matter content have encouraged acidification. The lower Casamance suffers particularly from water management problems. Clearing of vegetation has produced downstream soil erosion and paddy siltation and reduced the flow of fresh water into the lower valleys, increasing salt water intrusion.

There are a number of technologies to be explored to deal these problems. Some may have general relevance. Others may be specific to certain geographic or ethnic areas. Listed below, illustratively are some of the types of activities that will be undertaken, by the project to pursue the three themes of soil fertility, watershed management and farming systems. All of these technologies require socio-economic research to identify effective techniques already used by or acceptable to both women and men farmers. It is important to build on the farmers' knowledge of and strategies for use of their environment. Improved organo-mineral soil technologies imply increased labor, energy, and cash outlays that affect adoption.

1. Soil fertility

Population pressures leading to intensifying cultivation have reduced markedly periods of fallow throughout the region, but especially in the Peanut Basin. The clearing and cultivation of marginal lands has reduced grazing areas, leading to overgrazing and erosion of lands still available for livestock. Cultivation of fragile soils in the Peanut Basin has caused loss of organic matter, soil compaction and sealing, decreasing infiltration and increasing runoff. In the Casamance, intense cultivation on the plateaus has brought erosion and soil loss to the uplands and sand encroachment below.

In the Peanut Basin, soils which are predominantly sandy, rich in iron and aluminum (Al) with a low cation exchange capacity (cec) have a structure and fertility highly dependent on organic matter. Organic matter is extremely low, however, one to three percent in most areas, and high temperatures during the rainy season promote the rapid mineralization of the organic matter that exists. This in combination with the low cation exchange capacity results in few plant nutrients and low retention of chemical fertilizers.

A number of technologies can increase soil fertility.

Fallow systems: Improved fallow systems introduce woody perennials, grasses, and legumes into farming systems. More research is needed to identify and test appropriate species capable of producing substantial quantities of green manure in relatively short periods. Also certain fallow systems can provide secondary benefits such as increased fuelwood and forage supplies and stabilized soils.

Composting: Compost can provide sufficient nitrate to increase millet yields and rock phosphates can increase available P for plant uptake to levels comparable to single superphosphate responses. Research on composting can include studies of types of species most suitable.

Alley cropping and line planting: The planting of crops often done by women, between lines of leguminous trees and shrubs provides a sort of simultaneous fallow system without requiring farmers to hold off planting. Cuttings from the trees and shrubs produce green manure and protection from wind. ISRA has some experience with alley cropping in the lower Casamance; the technique is applicable elsewhere, but given variations in intensity of farming systems, labor requirements, and issues relating to species, spacing and timing of planting, considerable research is necessary to identify the appropriate trees and plants.

Organic and mineral fertilizer combinations: Research on the correct combination of organic and mineral fertilizers, including local fertilizers such as rock phosphates involves identifying the optimum application times and sequence for each crop and soil type. Crop residues and animal manure need to be incorporated into the soil after the animals have grazed harvested fields; hot weather during the rainy season can result in leaching and large nutrient losses.

2. Watershed Management

Population pressures have contributed to growing watershed management problems. Villagers cut trees and shrubs for firewood, animal feed and to allow mechanized tillage. Rather than being left to replenish the soil, crop residues are used for construction, thatching, fencing and animal feed. Harvesting, particularly peanuts, which includes the roots destroys soil structure and structure may be further damaged by poor tillage techniques. Cultivation practices such as the up and down farming carried out in parts of the Sine Saloum and Casamance encourage run off and channel flow. Sandy soils under rain and sheetflow tend to crust and seal increasing the possibilities of erosion. In the short term, channel flow washes away the most fertile topsoil and any applied manure or fertilizer. In the long term, channels cut the fields into small units which may be uneconomical to farm.

The Casamance suffers from siltation and salinization of rice paddies, due in large part to loss of vegetative cover on the plateau areas. The clearing of the vegetation, the result of expanding agriculture, has increased downstream erosion and paddy siltation and reduced the fresh water underflow into the lower valleys upsetting the normal balance of fresh and salt water flows.

Watershed management involves treatment of the entire watershed area with a variety of techniques on an integrated basis, but adapted to the socio-economic conditions of farmers in the area. It starts on the upper slopes, often consisting of shallow soils over laterite, with efforts to maintain vegetative cover.

Improved cultural practices on the lower slopes, including physical barriers, can control runoff and minimize erosion damage.

Contouring: Plowing, planting, cultivating, and harvesting on a contour can reduce surface runoff by trapping water in small depressions and decreasing the development of channels which increase the velocity and destructive nature of water run off.

Strip cropping and vegetation barriers: Alternating strips of different crops following contours can accentuate the benefits of contouring, but to have maximum impact, crop stubble or residue needs to be left on some of the strips. Often in Senegal, most crop residue has other uses and is not left on the field. Planting trees and shrubs along contour lines and establishing debris strips behind them using branches from trees can help control runoff and increase water infiltration. Research would concentrate on the most appropriate perennial grasses, tree or shrubs to use and low cost replacement materials for the uses now made of crop residue.

Tillage practices and mulching: The advantages of mechanical tillage, weed control, water infiltration, aeration, reduced labor, need to be balanced against potential damage to soil structure. In some areas, where rainfall is sufficient and soil structure adequate, deep plowing has increased yields. But in drier areas, it has increased wind erosion by removing shrubs, often the only vegetative cover, by their roots. Socio-economic studies will help determine the comparative advantage of tillage practices.

Tied ridging: Tied ridges are small depressions between crop rows which catch and hold water after a rain and increase water retention and infiltration. Particular research issues relate to their labor intensiveness and the extent to which they work on sandy soils.

Rock bunds: Rock bunds involve barriers 10-15 centimeters high made of laterite or rocks and placed on field contour lines according to the slope of the field. The barriers, while permeable, slow runoff, decrease erosion and increase infiltration. They are not as labor intensive as tied ridging and can be constructed in off-season periods, but the materials may not always be easily obtained.

Mulching: Crop residues on fields can reduce runoff and increase infiltration, but there is a finite supply and heavy demand for residue for fuel and fodder. Moreover, some preliminary ISRA research suggests that millet and sorghum straw may actually reduce crop yields; mulch also furnishes a good habitat for pests that are difficult to control without chemicals. Continued research in this area will help determine appropriate uses of mulching.

Natural forest management: Rather than planting a forest to protect upslopes, retaining permanent cover and encouraging protection of existing forests are more efficient ways of protecting against erosion. ISRA has been experimenting with natural forest management techniques. It appears that villagers can reestablish these forests with minimum costs and that biomass yields compare favorably with artificial plantations. The forests also produce significantly

greater secondary benefits in fodder, forage and medicinal plants than artificial monocultures. Further research is required on ways to increase the productivity of these forests while providing sustained yields over time, and ways to communicate this productivity to farmers. Grazing for herding is a relevant issue for the forest issue as well.

Farming systems, including integration of livestock and general agronomy

The press of population has affected the patterns farmers follow in their cropping systems. The need for immediate income has encouraged farmers to monocrop; demand for firewood and construction has eliminated trees from some systems; declining soil fertility coupled with cereals requirements for food security have reduced the amount of land available for fodder and forage crops.

Yet, as shown in the social and technical annexes, the benefits to be derived from diversification of production are considerable. Intercropping and crop rotation can increase ground cover, return organic material and fix nitrogen. They can increase income by sale of fodder and forage crops. Animals are important as part of the system, providing traction and manure, and a market for fodder crops. On-farm testing of improved varieties, the integration of traditional commodity research with cropping systems, can have an important impact on productivity and work on some tree species and types of living hedges can identify appropriate agroforestry technologies.

Intercropping: Intercropping can increase yield per acre and reduce risk by taking advantage of different planting times and growing periods. In moister areas, a forage crop, drawing on residual moisture, can be interplanted late in the growing season and will provide ground cover after harvest. Except around Thies, where farmers overseed millet with cowpeas, there is little intercropping in Senegal. Research under the project can examine the effects of intercropping on soil and crop productivity.

Crop rotation: Early research in Senegal has shown that there are some crop rotation patterns that are more productive than others. Interest in crop rotation, however, has been reduced by intensification of cropping systems as a whole, need to cut into fallow periods, and a growing prevalence of monoculture. The project will evaluate the advantages of rotation of cereals with non-cereals, particularly legumes, and the selection of appropriate crops to produce organic materials. Research on both the agronomic and the socio-economic factors affecting rotation decisions is needed, although difficult to do, because, as with agroforestry, conclusive results aren't possible in the short-term. Participatory research with farmers will provide some practical guidelines for the short-term.

Crop breeding and variety improvement: The project will not fund varietal improvement directly, but it does support strong linkages with research centers that do and the conduct of on-farm varietal

trials. ISRA has already developed a number of improved varieties of millet, sorghum, rice and cowpeas, in inconjunction with international research centers, and the project will support on-farm testing of some of the most promising varieties to measure not just technical characteristics but socio-economic constraints as well. Work on specific tree species such as acacia albida and cordyla pinnata or type of living hedges might also be included. In the past, for example, single line living fences of Euphorbia balsamifera and E. tirucalli played an important role in protecting crops from wind erosion and controlling livestock. Cordyla pinnata in the Peanut Basin, like acacia albida contributes to soil fertility, fuel, food, and forage, but little is known from a social or economic point of view on incentives to its cultivation.

Summary: As mentioned earlier, socio-economic determinants are key to the appropriateness of these technologies, and the project will fund interdisciplinary teams to examine options. The teams will carry out, among other things, micro diagnosis and design studies, similar to that already done at the macro level, to identify land use constraints, their causes and possible removal, and improved cropping practices to make better use of existing resources. The effectiveness of these teams in diagnosing needs and solutions will be greatly enhanced by farmer participation in the research process.

B. Economic Analysis

Robert Evenson's 1984 study of the benefits of public-sector agricultural research worldwide, "Agricultural Development in the Third World," showed rates of return greater than 20 percent in 31 of 35 countries. A research program based upon maintenance and management of a fragile resources base would appear to offer returns well within this range. Selected evidence from the limited data available within Senegal and from other countries in the Sahel is encouraging and seems to show that the project will generate a stream of benefits significantly greater than anticipated costs.

A 1990 study by James Seyler, "Acacia Albida in Senegal's North Central Peanut Basin," showed returns to farmers planting and maintaining acacia trees which compared favorably with those realized from investments in modern technology and purchased input regimes. A recent inventory of technologies developed at ISRA showed that water management, erosion control, and agroforestry can contribute productivity increases in the range of 40-180 percent (see table 1). Improving water infiltration rates alone, according to studies in nearby Mali, more than double disposable income. Further, the interactive effects of the technologies can yield returns in excess of 180 percent, according to a 1989 ICRISAT study. Improving the quality of the soil in the southern peanut basin is essential to stabilizing and increasing productivity, and in the Casamance and eastern Senegal, reclaimed soils could increase returns to labor 25-50 percent.

TABLE 1

Table 1

Percentage Yield Increases with Interventions

INTERVENTIONS	PERCENT INCREASE IN CROP YIELDS(a)	PERCENT INCREASE IN CROP YIELDS(b)	PERCENT SOIL RESTORATION (a)	FARM CALENDAR FOR INTRODUCTION OF INTERVENTION	YEAR YIELD INCREASE TAKES EFFECT	LABOR REQUIREMENTS PERSON DAYS PER HECTARE	
						(a)	(b)
WINDBREAKS	18		2.5	ONSET RAINY SEASON	5	4	4
ACACIA ALBIDA	24	152	6.0	ONSET RAINY SEASON	6	10	
LIVE FENCES	5		2.5	ONSET RAINY SEASON	4	16	14
AGRIC. CHEMICALS	75		5.0	PLANTING SEASON	1		
COMPOST/ORG. FERT	80		6.0	PLANTING SEASON	1	11	
CONTOUR RIDGES	6	50	8.0	OFF-SEASON	1	142	150
DRY PLOWING		22		OFF-SEASON	1		0.4
LIVE FENCE + RIDGES		30		ONSET RAINS+OFF SEASON	1		163
RIDGES+GULLY CONTROL		50		OFF-SEASON	1		4.5/meter

A draft financial analysis by Edward Karch analyzing a number of agroforestry activities concluded that the internal rate of return for investment in windbreaks, border plantings, live hedges, field trees, fruit and nut trees, was over 25 percent in each case.

TABLE 2

Agroforestry Interventions: Net Present Value (NPV), Benefit/Cost Ratio (BCR) International Rates of Return

	Intervention	Labor Cost Included			Labor Cost Excluded		
		NPV-FCFA	BCR	IRR	NPV-FCFA	BCR	IRR
1	Field Trees	18,988	1.95	32.5%	21,788	2.27	34.4%
2	Windbreak	3,621	3.13	44.8%	3,921	3.80	48.9%
3	Live fence	2,569	1.08	26.4%	8,569	1.34	30.5%
4	Border (field)	(23)	1.00	25.0%	1,977	1.13	26.7%
	Combined 1-3	42,341	1,60	32,2%	53,441	1.91	35.2%

Source: Karch, Edward, unpublished analysis for Senegal Reforestation Project, May, 1991.

Note: Does not include incremental yield gains

Table 3

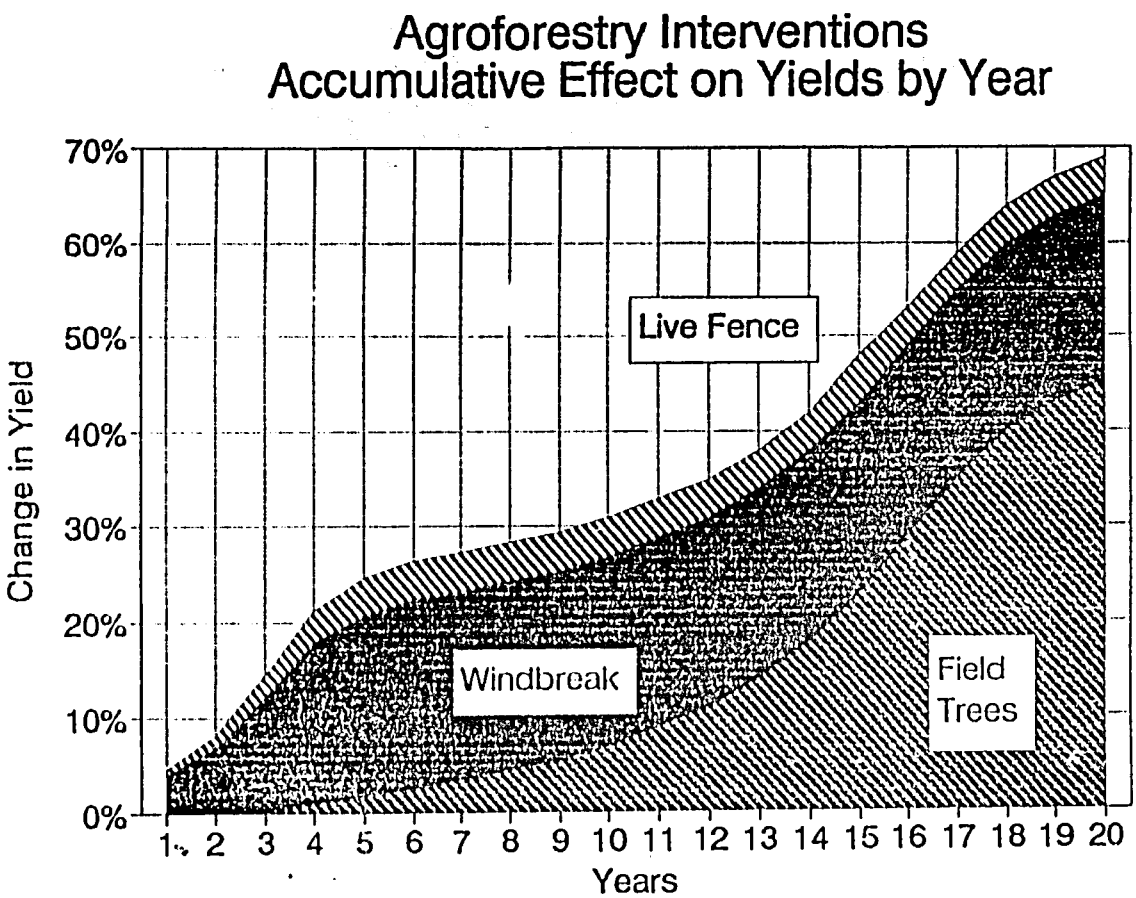
Available Crop Technologies, by Crop and Region
(Number are percent increase in yield compared to traditional practices)
(xxx indicates that trials and recommendations are available)

Technology	Groundnut Basin					Ziguinchor/Kolda			Niayes	River Valley	
	Groundnuts	Cowpeas	Maize	Millet	Sorghum	Rice	Groundnut	Maize	Veg/frui	Rice	Tomato
Land leveling						xxxxxx			xxxxxx	xxxxxx	
Soil preparation Varieties (short season) Seed quality Plant density Sowing/transplanting Nursery management	xxxxxxxx xxxxxxxx	250	50 - 100	xxxxxx	100 to 200	40 to 100	xxxxxxxx	xxxxxx xxxxxx	xxxxxx xxxxxx xxxxxx	xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx	xxxxxx
Fertilizer (date, dose)	xxxxxxxx						35	50		xxxxxx	xxxxxx
Treatment		xxxxxxx				7			xxxxxx		xxxxxx
Thinning Weeding(manual,chemical)		xxxxxxx		xxxxxx	xxxxxxx			xxxxxx	xxxxxx	xxxxxx	
Crop associations Crop rotation		xxxxxxx		xxxxxx				xxxxxx			
Integrating livestock											
Water management Soil conservation				30 to 180		xxxxxx				xxxxxx	
Improved equipment											
Agro-forestry Acacia albidia	Depending on the tree, soil nutrients (+20%) and organic content are increased. 44 150 Millet yield increase 145 kg per 0.1% increase in organi matter.										
Post-harvest protection		xxxxxxx									

Source: USAID/ADO technology review [various sources].
Note: The percentage yield information is representative, more specific information is available in the source document.

(options)

There is potential for sustained improvement in producer wellbeing from a combination of resource management interventions. As shown in Figure 1, a combination of live fences and windbreaks may increase yields by as much as twenty percent after only four years.



The Figure also suggests the importance of testing and disseminating "packages" of such interventions (a subject on which there is little farm-level economic or agronomic data). The importance of combining interventions such as windbreaks, where benefits peak after about six years, with field trees, where benefits begin to accelerate after six years is quite clear. There are also additional aspects that research needs to explore such as the combined influences of interventions on the stability of yields under varying climatic conditions. Data in the Senegal Agricultural Sector Analysis shows, for example, that moisture requirements for millet in moisture-retentive soils are about one-half the

requirements in low moisture-retentive soils. Given the enormous annual variation in yields for millet and groundnuts the food security and revenue implications of these kinds of interventions are remarkable. (Only about 16 percent of the variation in millet yields is explained by the tend - leaving 84 percent to other factors such as moisture availability).

The likely impact, in terms of food and cash crop production and eventually revenue, depends on how adopting farmers reorganize their production systems once the benefit stream comes "on-line". One way of looking at this is through crop budgets and resources constraints. The benefit/cost analyses discussed earlier were based on an assumption that yield benefits would be equal for all crops and that the crop "mix" would remain fixed. In fact, farmers can be expected to shift their production program in response to improved yields and the increased security that this implies. Equal percentages increments in productivity of both cereal and cash crops would mean that farmers could effectively shift land from cereals (essentially a subsistence crop) to the higher yielding cash crop (groundnuts). The result would be a proportional increase in net farm revenue from crop activities. An approximate measure of this adjustment is provided by simulations from a linear programming model of a "typical" farm in Southern Fatick shown in Table 4.

Table 4

Southern Fatick Farms
Per Hectare Increase in the Value of Farm Output and Land Values
(Selected Percentage Increases in farm Land Productivity)

Percent Yield Increase	Gross Value of Farm Output (FCFA/ha)	Net Farm Output (FCFA/ha)	Value of Land (Shadow Price: FCFA/ha)
Base	79,900	64,809	27,000
5%	82,900	67,783	28,700
30%	101,300	86,179	89,500
60%	136,200	117,150	128,400

Source: Simulations of the Southern Fatick Farm Model.

The data in Table 4 are for a farm family consisting of 9.7 persons, producing millet, maize and groundnuts on 8.5 hectares with access to animal traction and related equipment.

Gross Value of Farm Output is the value of all output (millet, maize, groundnuts and groundnut hay) at 1990 prices.

Net Farm Output is gross value less cash and non-cash costs.

Value of Land is the value of land, in terms of additional net farm output, of one hectare of land (the shadow price for land).

There are a number of ways of interpreting this data, depending on the kind of intervention employed. At base land productivity a hectare of land retained or reclaimed by erosion control would be worth 27,000 FCFA/ha/year, which, for a period as short as five years at 15 percent interest, would have a present value of over 90,000 FCFA or 72,000 at a discount rate of 25 percent. In other words, at a 25 percent discount rate, a farmer should be willing to invest 72,000 FCFA to reclaim or retain one hectare, even if there is no productivity gain involved. This kind of intervention would need to take place in the off-season using family labor and amounts to the equivalent of about 144 days of labor 500 FCFA/day.

An intervention such as live fences plus contour ridges is estimated to increase yields by 30 percent in one year (see Table 2) and to require 163 days per hectare. The present value of a 22,000 FCFA increment in the net value of farm output, discounted at 25 percent is 57,000 FCFA for a five-year horizon and 76,000 FCFA for a ten-year horizon. These values are within the range of the generally accepted opportunity cost of labor at 500 FCFA/day at relatively low productivity increases.

A number of possible interventions with impacts in a range of 30-180 percent have been identified (Table 1). Similar calculations for the incremental net value of output for an intervention which produces a 60 percent yield increase would support an investment of around 187,000 FCFA per hectare, or labor valued at over 1100 FCFA per day for 163 days.

The calculation of costs and benefits for natural resources investments, however, is relatively new, and the evidence, while encouraging, is not conclusive. Data is difficult to get and accounting for all returns to natural resource interventions often elusive. The measurable impacts are increases in crop or wood yields over time. Often, substantial time is required, 5-7 years would be minimal. Interventions including trees can push the schedule out much further, delaying computation of benefits well beyond a decade.

Estimates cited in a recent evaluation of USAID/Senegal's Reforestation Project states that based on past research one could assume that 50 acacia albida trees per hectare will increase millet production 12 percent per year in years 6-10 after planting, 24 percent in years 11-20 and 50 percent in years 21-40. These assumptions produce an IRR of over six percent after ten years, 20 percent after 20 years and 22 percent after 40. In addition, a well established acacia, between 16 and 20 years old, may be able to produce a ton of pods annually which can be used for cattle fodder.

The difficulty in getting data is confirmed by a study done for AID/W's Natural Resources Management Support Project. The August 1990 study said that "yield assumptions (for wood and crops) are difficult to specify. Hard information on yield responses to Natural Resource Management interventions over time rarely exists except for single or few scattered data points. Huge data gaps are the rule, rather than the exception. We do know that NRM interventions have favorable impacts on the rate of soil degradation, but not by how much and when." The biggest challenge, the report concludes, is "collecting reliable data over time to be able to accurately project the impacts of NRM interventions on crop and wood yields."

The NRMS study also notes the dilemma of non-quantifiables that affect the value of NRM activities to farmers. Crop and wood output can be measures, as can forest-related benefits such as medicines, food, forage, beauty products, charcoal, building materials, to the extent that they are sold in local markets. But often natural resources have scenic, religious or symbolic values, or effects such as watershed management improvement on production down stream, that are extraordinarily difficulty to quantify, but important to farmers in assessing the value of natural resources technologies. Finally, benefits derived from ISRA's development of a natural resources-based agricultural program should also benefit other research institutions and through them farmers in the region because of the growing communication encouraged by the Special Program of African Agricultural Research (SPAAR).

The extent to which the economic potential of the project can be realized depends in large part on institutional variables and social constraints dealt with in some depth in the institutional and social analyses sections. They include: ISRA's financial and research management capacity, the development of a stronger research-extension-research linkage, direct farmer participation in research planning and execution, effective interdisciplinary research teams within ISRA, connections with international and other national agricultural research organizations, continued government and donor support. Early in the project baseline surveys, including the IFPRI/ISRA household income survey now underway, will provide the starting point for measuring economic impact of the new technologies being tested by ISRA. Regular monitoring and evaluations will track progress towards overcoming institutional constraints or labor constraints.

C. Financial Analysis

Despite progress since USAID's studies of ISRA's financial problems in 1990, financial crises continue to plague ISRA's management and weaken its research program. ISRA's recent reorganizations have helped consolidate operations and cut its salary and administrative costs. Management efforts to streamline the organization and create a self-sufficient, core program, have begun to have an encouraging effect on staff morale, and centralized control of expenditures, although sometimes cumbersome, has sent a distinct message from management its seriousness in cutting costs.

ISRA remains in debt with its financial crisis largely beyond its control. Financial data gathered is not analyzed; manuals of procedures and systems are out of date or unused; costs can't be assigned to individual projects nor are accurate estimates of individual program needs available; decision makers are unable to get the information they need in timely fashion or in a form in which they can use it effectively. The problems of limited staff, insufficient funding for training, outdated or ignored systems, and inappropriate or underutilized equipment cuts across all [illegible] of financial management, administration, accounting, financial services, and information.

Financial management: ISRA's Director General has overall responsibility for accounting, financial management, and budget preparation and expenditure controls. Cash accounting is handled by the Agent Comptable Particulier (ACP) which was formerly under the Centre des Etablissements Publics (CEP) and the Agence Comptable Centrale's system attached to the Ministry of Finance, but this function has to become the responsability of ISRA. The ACP reports to the director general. Financial services, a separate division including financial studies, procurement, contracts a[illegible] under the secretary general.

[illegible] control process: The accounting process is methodical and employs a double accounting system, both manual and computer[illegible]. Each center has to fill in by hand the accounting re[illegible] for submission monthly to the ACP accompanied by all vouchers and documentation. This information is then put entered in[illegible] the [illegible] computer system at ISRA. For the payroll, ACP continues to send to the ACP a statement of transactions to be verified and entered into the accounting system. The result is a cumbersome system which when coupled with ISRA's shortage of accountants due to high turnover and difficulties recruiting and retaining qualified candidates, causes significant delays. The processing of vouchers prepared by the research centers are often two-three months late constraining research programs and aggravating suppliers.

Accounting entries are not current; audits have not been completed and the books certified since 1988, and the independent firm responsible for auditing ISRA is refusing to do further work until they are paid for that which has already been done. According to ISRA officials a major constraint impeding timely development and issuance of financial statements is the viability of the computer system to generate consolidated reports at the headquarters' level of the quality received from the centers.

As a result, ISRA is operating on an immediate needs basis, suffering from chronic cash flow shortages and unable to engage in proper budget planning. The inability to control expenditures and the constant shortage of funding has led ISRA's Director General to require approval for every expenditure over $175, a degree of centralization which, while imposing absolute control and accountability, severely restricts the ability of field researchers to respond to immediate needs.

The budget process: The budget process has also suffered from delays, sometimes the fault of ISRA, sometimes due to problems with funds promised by donors. The process begins in September-October when researchers prepare budgets for the following year. The program coordinators and research directors are responsible for carefully reviewing the budgets before monitoring them to the secretary general. The research directors have the major responsibility for planning and budgeting for their departments. If the budgets require further work or revision, the Secretary General sends them back to the research directors. The Secretary General coordinates the overall ISRA budget which is finalized in November/December. The final budget, reviewed and modified by the Director General, is then sent to ISRA's board for approval in December. In some cases, however, the approval is much later. For example, in 1988, the budget was not approved until May and World Bank funds did not arrive until July, causing severe problems for field research since 80 percent of research expenses occur during the months of June and July.

Once the budget is approved, the Secretary General gives the budget forms to the UIG (computer unit) for entry into the computer with copies to the research directors and centers. In March/April, the research departments are asked by the Secretary General to review their budgets and prepare a revised/modified budget (budget remanie). This budget revision allows researchers, research program coordinators, or research directors to the change budget line items and reallocate resources in preparation for the rainy season. These revised budgets are submitted to the Secretary General before June and then published and distributed.

The process is complicated because funds for some research programs, CIRAD, for example, and special projects, such as the CRSPs, are not included as part of the normal budget process. They flow directly to the station or center, and while not subject to the same delays, make centralized budget planning more difficult. Implementation difficulties are compounded by the fact that funds budgeted are often slow to be released by the Ministry of Finance or when they do arrive are significantly below the level planned. The lack of direction in the coordination of donor assistance results in less than rational use of available resources. There is no systematic recording of donor agreements and financing arrangements, although the capacity exists within ISRA's data system to do so.

Budget control: Theoretically, ISRA's financial management should be stronger. ISRA has a modern information system, largely funded under the first phase of the World Bank Project, which includes a a IBM 36 mini-computer, supercompacts, micro computers and peripherals spread throughout ISRA's headquarters and its research centers and stations. ISRA has a COSYS software package capable of processing the data requirements of both the ACP and the Financial Services division. Problems of differing accounting plans were resolved several years ago with the adoption of a uniform plan. Substantial data is available at ISRA, and a procedures handbook, developed in 1987, and a computer system handbook provide clear guidelines for system operation.

The real constraint on effective budget control has not been a shortage of hardware or programs, but results from ISRA's lack of trained manpower, not only in the accounting section but in financial management as well. Efforts by the World Bank, including a management controller, financial analyst and accountant, ended in 1988 and made some progress in putting a system in place. But, counterparts trained under the program have left ISRA and current staff lack expertise to take advantage of the procedures and systems promoted by the technical advisors. Existing equipment is not used properly, available data is not gathered and analyzed, and managers simply lack the information required for decision-making.

The current crisis: The inability to impose financial controls, to maintain accountability and to have ready access to financial information required for serious financial planning and management has reached crisis proportions. The crisis has been compounded by delays in World Bank funding for the second phase of its agricultural research project with ISRA, the postponement of AID's research project originally planned for 1990 and the difficulty the GOS has in providing on a timely basis the 1.4 billion CFAF level promised in conditionality with the World Bank. Scarce resources are being allocated to pay current bills, especially salaries, rather than being allocated according to research priorities or, in some cases, to the programs for which they were intended. Field work and research programs lack secure funding, and ISRA has been unable to pay for maintenance and amortization of infrastructure and equipment, resulting in a steady deterioration of stations and facilities.

Assuming that donor and GOS funds can cover ISRA's program costs for the next five years, ISRA and its supporters will have to make a major effort together to ensure the financial systems are in place and a capable staff trained in order that money allocated goes to the right place and is used efficiently. A number of steps will need to take place, some immediately after this project gets underway. They include:

a) Bring audits up to date, revise and put in practice ISRA's procedures manual;
b) hire an assistant chief accountant;
c) train staff;
d) purchase additional equipment;
d) develop formula for calculating ISRA's indirect costs;
e) evaluate existing management information system including configuration of computers, peripherals and software, update and revise as required;
f) develop and put in place a new program for fixed asset management including inventory controls, procedures manual, training for staff in inventory accounting, and additional technical staff;
g) put in place a system for coordinating and tracking donor and GOS funds.

Financing for the five-year plan: The government is committed to paying ISRA's total personnel expenses, utilities, taxes and non-incremental recurrent operating costs. Donors finance virtually

all research program costs, but pay no salary or indirect costs. The result has been that donors play a critical role in setting research priorities by deciding which research programs get funded, and ISRA is totally preoccupied with meeting indirect costs.

ISRA's five-year plan sets a budget of about $16 million per year, excluding technical assistance and training, estimated as follows:

Source	millions US$ ($100 = FCFA250)	Percent
GOS Budget	5.9	37
ISRA's revenue	1.2	8
World Bank	3.0	18
French	1.6	10
Other donors, research contracts	1.4	9
Residual, to be financed	2.9	18
Total	16.0	100

The GOS is, by far, the most important funding source for the five-year plan, providing, if ISRA's own revenues are included, nearly two and a half times the amount of the next most important source. The GOS funding, 0.9 percent of GDP, is considered reasonable in terms of overall government resources when judged by international norms. Nevertheless, domestic resources are inadequate to finance personnel and indirect costs. The planned restructuring--a cut in staff of 37 percent--will reduce ISRA's wage bill by 25 percent.

Despite efforts to cut back on staff and consolidate operations, ISRA is still saddled with a past debts. ISRA currently has 2.2 billion CFAF in outstanding ISRA debts, including 425 million CFAF to state enterprises, 564 million CFAF to private merchants, 225 million CFAF to employees, and about one billion CFAF in debts from overdrafts from the GOS in 1988, 1989 and 1990. ISRA continues to live hand to mouth.

The implications are that ISRA will have to find additional ways to cut costs and improve efficiency. More than research program consolidation may be necessary to reduce costs to available resource levels. Issues of research program size and priorities need to be revisited, and financial management will have to be strengthened to insure scarce resources are judiciously matched to priorities. The Natural Resources-Based Agricultural Research Project will provide training and technical assistance in financial management to do this including:

Internal controls: development of an organizational plan clearly designating responsibilities between the Control Gestion, Secretary General, and Agent Comptable Particulier and separating lines of responsibilities (recording versus approval); better segregation of duties in all areas of operation; improved and updated procedures manual; provisions for testing for compliance with established policies and procedures and development of a checklist for field trips and management and operations reviews.

Expenditures control: trained staffing to assure accounting entires are timely and adequately recorded; timely accounting reports from each center and revised design of reports by the information unit to assure easy consolidation at the headquarters level.

Budget control: improved recording of all programs and core funding; improve reporting system to provide managers with clear picture of level of budge, income, encumbrances, disbursements and unliquidated expenditures.

Inventory control: development of a procedures manual improved administrative controls of non-expendable property, supplies, fuel and vehicle usage; reporting system to advise ISRA management on status of inventory; improved inventory reports, schedules and reconciliation statements.

D. Institutional Analysis Summary

Senegal's only agricultural research organization, ISRA has a long and varied history and a number of important strengths, particularly its organizational mandate and its motivated and qualified staff. However, institutional weaknesses both significant and insufficiently addressed limit ISRA's ability to contribute to the national agricultural economy. The project will build upon ISRA's strengths, develop plans to address its weaknesses, and assist ISRA staff to measure its economic impact in order to increase its overall effectiveness and image as a partner in economic dévelopment in Senegal. What follows is a quick review of ISRA's institutional strengths and weaknesses. This section concludes with a suggested medium-term course of action designed to overcome the principal institutional problems: financial, personnel and research management and staff training.

Overview: One of the strongest national agricultural research institutions in West Africa, ISRA has considerable physical infrastructure, a lengthy history of agricultural research, and a well-trained and motivated research staff. ISRA is the only National Agricultural Research Service (NARS) in West Africa which encompasses livestock, agronomy, forestry, and fisheries research into a single national institution. The integration of all research into one institution is a major possible asset.

However, ISRA continues to rely heavily upon donor financing and, to a lesser extent, expatriate technical assistance, to carry out a broad, ambitious research program with little focus. ISRA has yet to develop a true, national research program, and donor financing continues to skew its research agenda toward available funding. Furthermore, the quality, performance and impact of current research programs, particularly in areas most closely related to USAID's long-term strategic interests, are of concern. For example, ISRA has spent considerable effort on commodity-based research with a disproportionate share of these resources allocated toward plant breeding. Food crop research has traditionally relied more upon improved varieties and purchased agricultural inputs rather than upon lower cost, more sustainable technologies. Crop-specific and farming systems research work has been insufficiently coordinated resulting in commodity-focused research that address farm-level constraints identified by farming systems research. Farmers and extension agents have insufficient opportunity to assist in setting specific research program priorities. Livestock research findings are not adequately integrated into livestock and crop production systems research. These problems are not specific to ISRA but are problems common to research institutions the world over.

Insufficient donor and GOS attention in the past to the need to strengthen ISRA's as an institution, coupled with a financial crisis requiring staff reduction and reorganization, seriously hinder ISRA's ability to plan, manage, and implement its program. Inability to manage resources, whether financial, physical, technical or human, is the major institutional constraint identified. Complicating the situation is the failure to coordinate donor support resulting in the diffusion of limited resources and duplication of efforts while increasing the ISRA's management burden.

GOS budget support to salaries and recurrent costs is insufficient and poorly managed. A multitude of uncoordinated donor agreements, proliferation of programs, funding sources, and systems and inadequately trained financial and administrative personnel further contribute to ISRA's administrative and thus technical problems. Particularly of late, poor financial planning and management have weakened ISRA's ability to plan, execute and evaluate an effective research program with significant impact.

Improvements are underway and opportunities exist. A GOS mandated re-organization, largely to bring runaway costs in line, has resulted in a reduction in staff. Nonetheless, ISRA continues to suffer from recurrent cost burdens from previous years and a recent GOS review of ISRA has called for another dramatic organizational reform. ISRA has prepared recommendations to be reviewed in the near future. As ISRA undertakes a significant, bottom to top, institutional reform, a unique opportunity exists for USAID to make a significant and lasting contribution to ISRA as an institution.

The project will help ISRA address technical and administrative staff weaknesses through long and short-term academic and technical training. Technical assistance can support a review and refinement of the financial and accounting system to increase its responsiveness to managements' requirement. Importantly, the project can train ISRA staff in financial management and accounting and, if needed, procure computer equipment and software. Short and long-term assistance in research planning and management can help bring human and financial resources in line with a research agenda that is more focused and demand driven. The strengthening of ISRA' management will increase dramatically its ability to generate farmer-oriented, inter-disciplinary, natural resources based agricultural technologies on a sustainable basis.

Research management: ISRA's greatest management challenge is to bring its research program in line with its existing financial and human resources and to focus its priorities on the areas of greatest need for farmers. Its five-year plan serves as a formal statement of priorities, idealized without concern to financial realities, and a more recent listing of priorities by the Scientific and Technical Committee tends to reinforce research along department lines, rather than encouraging interdisciplinary research. Critiques of ISRA's have already been outlined in the section an "approach to research" under "Project Outline and Strategy."

Some of the concern about ISRA's ability to plan and manage its research portfolio is being addressed by the reorganization. Criticism of the focus and the method of conducting research has been partially addressed by the development of farming systems research over the last decade. Farming systems research has improved the definition of research problems and knowledge of applicable technologies. It has also introduced an interdisciplinary, on-farm research methodology now accepted and producing research of greater relevance to farmers.

The project will build on initiatives that ISRA has already started through its restructuring and through its farming systems program. It will provide technical assistance in research planning and budgeting to improve ISRA's system of defining its research priorities, preparing and reviewing research proposals, linking budget to priorities, and rationalizing its administrative structure to reduce bureaucratic constraints on field research. At the same time, technical assistance and funding of the small grants program, will help ISRA address issues relating to its method of research, encouraging farmer participation in planning and carrying out research and building a tighter link between researcher and beneficiary.

Financial management: A complete description of ISRA's financial problems faced are found in the financial analysis. It is clear that a serious and growing financial crisis exists. Despite a healthy percentage of GDP allocation to agricultural research, funds are insufficient to operate the institution without continued external support. Morale of staff and image of the institution are

seriously affected. Research work is compromised by the failure to assure sufficient resources on time. The wage bill, ISRA's largest expense, has been reduced by the recent reductions in force, but salary costs continue to absorb most of the GOS budget and significant financial budgeting and management reform work remains.

At an institutional level, there is an overall lack of experienced personnel, the existing powerful computer system is inappropriate and thus under-utilized, no system for indirect cost accounting exists, and there is no information system enabling senior management to make sound decisions on resource allocation. Finally, budget controls are not respected and accounting for funds is weak, slow, and inaccurate.

Technical assistance to ISRA to define its "noyau dur" or core national research program will require corresponding assistance to ISRA to train staff and institute a strengthened financial planning and management system. Short-term in-country financial management and accounting training is planned under the project.

Personnel management and development: ISRA has recently undergone two reductions in force. However, no personnel management system exists to provide incentives to researchers, to attract or retain scarce specialties, or to evaluate for selection out. No long-term training plan for staff development exists. Donor funding for administrative staff training has been limited in the past as donors concentrated upon increasing the number of trained researchers in agricultural sciences.

ISRA now employs a total of 558 Senegalese in 12 research centers or stations including the Dakar headquarters. Administrative staff and laborers make up a financially unhealthy 40% of the workforce. ISRA employs a total of only 53 women of which 32 are secretaries and only six are research assistants or superior technicians.

Judgments about staff quality are difficult, given the lack of a personnel evaluation system. ISNAR, is helping ISRA to develop a system to evaluate personnel to permit promotions, selection out and training decisions. A salary wage scale review is planned. ISNAR's training needs assessment showed sizeable training requirements and identified priority training needs, both short and long-term. For example, ISNAR estimates that annually four ISRA staff members should enter graduate programs (MS or PhD) to maintain researcher levels and realign disciplines. ISNAR also recommended that four members should begin undergraduate progams annually in order to strengthen ISRA for internal recruitment for available researcher positions.

Many of the identified training needs can be supported under the project's planned degree-level training programs. Shortages in key areas, loss of personnel due to resignations, pose important constraints on training programs, particularly long-term. An ISNAR-led review of resignations showed sensitive areas in both

agriculture and non-agricultural disciplines, especially forestry, sociology, computer science, areas of critical interest to the strengthening of ISRA and the generation and measurement of natural resources-based technology.

Based upon the design team's review of ISRA as an institution, we feel that ISRA has the potential to become a viable, productive national agricultural research system. It possesses important assets including: 1) a sufficiently large, diverse, and well-trained scientific staff; 2) a well-established research program addressing the principal commodities in the major ecological zones; and 3) a physical infrastructure and presence in the field. Additionally, ISRA leadership is committed to essential institutional reforms and has begun the important process of political consensus building. Nevertheless, ISRA faces considerable institutional challenges: a destabilizing financial crisis and a set of financial, research, and personnel management issues that must be addressed in a coherent multi-donor coordinated framework. The project seeks to secure GOS commitment to long-term financial support to a core research program. It plans to address inherent management weaknesses through specialized training and improved systems management. The development of a medium and long-term, problem oriented research program will be a focus of the technical assistance team. A sizeable participant training program will address continuing training requirements at ISRA.

The project is a significant undertaking that will provide technical and financial resources to ISRA at a critical point in its development as an institution. Well conceived, well implemented but flexible support to ISRA as its undertakes institutional reform and grapples with its major institutional problems can make a very considerable and lasting contribution to ISRA as a national agricultural research institution.

E. Social Soundness Analysis

The principal beneficiaries of the project are those farmers living in the reliable rainfall zone (400 mm or higher) who experience increased cropping systems productivity as the result of improved management of natural resources. The extent of those benefits will depend on a number of factors: the willingness and ability of ISRA researchers to develop a collaborative approach with both women and men farmers; farmers' interest in participating in the research process and the ability of private, non-governmental and farmers organizations and extension agencies to encourage farmers' participation; labor availability; and land and tree tenure issues. Analyses of changing gender differences in knowledge and roles related to natural resource management, in the different eco-zones and ethnic groups, will be an important element of this research in order to ensure that women as well as men farmers participate in and benefit from this effort.

The Project Zone

The project's zone covers virtually all ethnic groups in Senegal with a diverse set of production and livelihood strategies. Within this wide range, however, are certain trends which, while not universal, are relevant to the vast majority of small farm households. Of overriding importance, most small producers share the problem of meeting family grain consumption needs. Many consume their homegrown grains within six months of harvest, leaving them to patch together alternative means of support during the rest of the year.

Problems with traditional cash crops, peanuts and cotton, have forced farmers to diversify into a variety of alternatives such as cassava, melons, sweet potatoes, and pumpkins. Animals also play a critical role, and most families raise at least small animals. Where possible, farmers invest in larger animals, donkeys, horses and cows. Tree crops and forest products supply food and income, and sizeable income may be generated by orchard crops such as mangoes, oranges and a range of local fruits and forest products including medicines.

Some villagers, of course, head for the cities during the dry season. Others rely on remittances from relatives already working in urban areas or outside of Senegal. Fishing, food processing and crafts are alternatives sources of income, and a recent ISRA/IFPRI study shows villagers engaged in 35 different income-generating activities, not including agricultural production.

Food security measures and the increasing diversification of income sources have blurred traditional ethnic differences and gender roles. While traditionally men have been responsible for supplying food grain, either by producing or buying it, and women charged with the vegetables, sauces and condiments, hard times have forced both men and women to look for income generating activities.

The Role of Farmer Participation in Natural Resources-Based Research

Natural resources play a critical role in farmers' strategy of opportunistic diversification, for example, farmers use leaves to feed animals to produce manure to increase yields, revenues from forest products to buy staple foods and forest foods to supplement diets. Many farmers already practice traditional methods of natural resources management, and it is in this context that farmer participation in research is particularly important. To be effective ISRA's, research agenda needs to reflect both men and women farmer's concerns and objectives and take advantage of indigeneous knowledge of local conditions.

This does not mean that on-station or in-laboratory research is unimportant. Laboratory, station and participatory research are mutually reinforcing. Because ISRA, as most national agricultural research centers, has focused on top-down, transfer-of-technology approaches to research and extension, the project needs to emphasize farmer participatory research processes through encouragement,

incentives and resources in order to reach an appropriate balance between the two.

ISRA's Ability to Do Farmer Participatory Research

While much of ISRA's research has been concentrated in the laboratory or on-station and has followed a traditional, transfer-of-technology model, it has been moving haltingly toward more on-farm work and farmer participation. The Production Systems Research (PSR) teams funded in large part by AID's Agricultural Research Project, have made regular progress towards greater collaboration with farmers. Particularly at the Djibelor sub-station and at Kaolack, researchers have begun to work closely with farmers and with farmer organizations.

Several things might be done to overcome initial resistance to participatory research. Joint study tours for ISRA researchers and farmers to visit projects where farmer participatory research is working well, Ivory Coast, for example; seminars to discuss the principles and practices of farmer participatory research; practical training for ISRA scientists in participatory research methods such as rapid rural appraisal could be funded under the project. The technical assistance team can help identify journals and conferences to which ISRA researchers, particularly interested in farmer participatory research results, can refer or submit their findings.

Farmer Interest in Collaboration with ISRA

The project seeks to encourage linkages between ISRA and established farmer associations, village organizations and NGOs to enhance participatory research, communication and dissemination of an successful technologies. More than 25 well-established associations, ranging in size from several hundred to more than 10,000 members exist already, and their numbers are rapidly growing. A new project, Le Programme de Recherche-Appui des Associations Paysannes (PRAAP), funded by the Canadians and Ford Foundation, aims to "facilitate participatory research and planning activities that strengthen the capacity of multi-village farmer associations in Guinea, Senegal, Mali, Guinea Bissau, and Gambia." Headquartered in Dakar, the project will complement efforts under the USAID project.

Moreover, some organizations such as CADEF, are already participating with ISRA. They have approached ISRA with specific problems and have worked with ISRA scientists to find solutions. American PVOs such as Winrock and Rodale have also cooperated with ISRA on research efforts, with Rodale focusing particularly on natural resources approaches to increasing production.

Women and Farmer Participatory Research

While it seems obvious that women farmers should be involved in such research, for various reasons, they are often left out. One major constraint on the participation of women in farm participatory research is the lack of women either at ISRA or in leadership positions in field organizations. Since there are only seven women researchers among the 115 at ISRA, most interdisciplinary teams will not have women. But putting women on the team does not ensure the involvement of women farmers. The research agenda needs to include gender analysis and the participation of women farmers.

The project can address this problem in part by focusing on training women, including women at the lower levels of ISRA's staff (technicians). In forming interdisciplinary teams, ISRA can hire women as full-time researchers or as consultants to participate at critical junctures such as in initial studies and needs assessments. In selecting partner organizations, ISRA should identify those that have strong representation by women. In evaluating research, USAID and ISRA should consider gender issues and in monitoring activities, reports should track the number of women participating in research, both farmers and researchers.

Constraints to Farmer Adoption of Natural Resources-Based Technologies

Labor constraints: Measures to improve natural resources management, while often not capital intensive, tend to require significant labor. Farmers will judge the importance of investment in such technologies in terms of their labor opportunity cost. This will vary according to season, the number of family members available to work, and alternative sources of income. In degraded areas, where food production is more difficult, families are more dependent on off-farm activities than in more productive agricultural zones, and thus it may be more difficult to attract people to adopt labor-intensive, yield-improving technologies in these areas. The farmer's decision to invest labor in marginal areas is also affected by the fact that labor invested is more risky due to limited and variable rainfall.

Water shortage: Concerns about labor may be complemented by concerns about the lack of water from wells or ponds during the dry season to maintain tree seedlings, animals or living hedges. Some water infrastructure is necessary for certain natural resources-based technologies to get started.

Land and tree tenure: Official regulations and customary rules that may vary considerably between regions and ethnic groups can make a significant difference in the incentives or disincentives perceived by farmers looking at possible natural resources investments. Conflicts are likely where land use patterns are changing, farmers are making improvements on public or common lands, or areas are recently settled.

Tenure issues can be further complicated by religious, gender, and ethnic issues. Sizeable tracts of land in the peanut basin, for example, are devoted to commercial peanut production organized by religious leaders, who are central to any discussion of natural resource management there. Their commercial practices involve cutting trees in order to cultivate vast tracts of peanuts using mechanized equipment on fragile, sandy soils, and they have great influence over small holders in the region. Their interests may conflict directly with herders, largely Peuls who are semi-nomadic. Land control, including fences and bunds, can cut passage of animal herds and disrupt traditional migration patterns.

Group organization and leadership: Linked to questions of tenure and water availability is the issue of village level leadership and the ability of local communities to mobilize. Effective natural resources management often demands actions by more than a single individual. Getting villagers to collaborate will take leadership. The extent this will happen will depend on ISRA's ability to incorporate villagers into their research planning process. Also important will be the support of religious leader in persuading their followers to pursue more environmentally sound priorities.

Outlook Using genuinely participatory approach to research, ISRA will collaborate with farmers' associations, non-governmental organizations and extension agencies, to address the most important aspects of the constraints outlined above. By combining farmers' understanding of their local situation and political, and social and technical sectors affecting productivity, with ISRA's technical capacity, research planning will be able to account for variations in natural resources management practices between villages and climatic zones. The results should offer farmers a range of options specifically geared to their needs. Farmers' associations will be able to better assess the potential of long-term interventions and overcome some of the organizational issues likely to arise in farmer participatory research. The research should look closely at tenure issues, and ISRA's social scientists should include tenure as part of their analysis.

VII. Monitoring and Evaluation Plan

I. MONITORING PLAN

Overview: Monitoring natural resources-based research is difficult because the relationship between the provision of inputs such as technical assistance, training, commodities, resource management technologies and their direct impact upon food production or increased incomes, is not always clear. Measuring the inputs against farm-level "outputs" is complicated by long lead time between technological generation, farm-level adoption, and measurable impact. The "program level" monitoring plan acknowledges the difficulties in measuring such a process, especially, as this project emphasizes farmer-assisted research and technology development where hard data will be difficult to find. This project will be monitored at both the project and program level. Indicators for each level of monitoring will be established to track progress against stated goals, objectives and project purpose. All indicators referring to participants or beneficiaries (people-level indicators) will be gender-disaggregated.

Project Monitoring: At the project level, the following project components will be monitored: provision of inputs (technical assistance, operating expenses and funds for training, etc), the participant training programming, the technology generation and transfer process. The project will monitor ISRA's capacity by review of budgets, quarterly financial reports, training and research program plans and outputs. The AID project officer will work with the contract team and ISRA counterparts to design specific monitoring activities, indicate monitoring activities for each component of the project the data to be collected, who will collect and analyze the data, and the reports to be issued. As defined, this is "routine" USAID project implementation monitoring largely based upon annual workplans, and monitored in PIR meetings through reports, site visits, and discussions with counterparts.

Program Monitoring: While discrete elements or components of the project will be specifically monitored, as mentioned above (levels of inputs, personmonths of technical assistance, timely development and submission of annual workplans, quarterly reports, etc. from the contract technical assistance), there is also need to review the project at the output and purpose level as it contributes to the overall Mission strategic objectives. Thus, a preliminary list of indicators for each level of program monitoring is highlighted below. Indicators have been developed for measuring progress on the strengthening of ISRA as an institution (financial management, research planning and research management), for example. Illustrative indicators have also been developed for measuring the number and type of technologies generated, their adoption rate and the economic and social impact of these specific NRMs based technologies on farmer's fields. Some indicators can be considered both "project" level indicators as well and programmatic level impact measurements.

Baseline: To assist in the quantification of the indicators for both project and program level, the contractor will conduct a "baseline" review. The baseline indicators will be developed subsequent to the approval of the PP with assistance to be provided by AID/W. The baseline review will describe ISRA's strengths as an institution including such things as personnel numbers, linkages to other institutions, GOS and other donor funding levels, and adequacy of financial and administrative control procedures.

USAID will contract locally for a field-level review of existing farmer utilized technologies and strategies for natural resource management which will assess and quantify their present and potential economic impact. This field level review is referred to as a "technology inventory". It will systematically examine 1) effective indigenous resource management technologies; 2) technologies developed by ISRA and adopted or adapted by farmers; and 3) technologies developed by ISRA but as yet not transferred to farmers' fields. The development of the technology is not a static process but rather a process of identifying what is being practiced, what the agronomic or economic impact of this technology is, and what are the constraints to further adoption of the technology. The inventory work, to be carried out by local consultants with assistance from ISRA and from the extension department, will involve rural sociologists, agricultural economists, and agricultural specialists in agronomy, soil science, etc. This "inventory" or technology assessment will estimate current adoption rates and identify constraints to further adoption of these technologies. The field level review of existing technologies will be limited to the prescribed geographic zone, i.e., areas receiving more than 400 mm of rainfall annually. The scope and rationale for the monitoring of the project at these various levels and for these various purposes are discussed below.

Developing Farm-Level Indicators: Some project-level indicators may also be relevant for monitoring program level impact. Thus, indicators must be carefully developed (farm level pre-trial data and data on ISRA as an institution, for example) to serve both purposes. Developing specific, measurable and cost-effective indicators at the field level may require design or re-design of certain of ISRA's research reports (see farm-level trials below).

USAID Monitoring Responsibilities: The Chief, Agricultural Research Division, of the Mission's Agricultural Development Office, will have primary responsibility for coordinating the monitoring of the progress of the project. In addition to periodic project monitoring conducted by USAID (site visits, project implementation review reports, review of annual workplans), there will be two, semi-annual joint monitoring reports issued by USAID and ISRA. These semi-annual monitoring reports will be based on data provided by the technical assistance team. The ADO project officer will also be responsible for coordinating and ensuring a program-level monitoring plan as described below.

Monitoring at the Project Level:

1. Farm-Level Trials - Predicting and evaluating the impact of technological change requires careful selection of farm-level indicators such as returns to land, returns to labor, and overall productivity of the farm system (crops, animals and tree products). Monitoring of farm-level activities is the responsibility of ISRA's researchers (alone or in conjunction with the T.A. and/or collaborating NGO/PVO's). However, the TA team will design the monitoring system in collaboration with ISRA to capture relevant social and economic impact data, not just agronomic responses to the technology introduced.

2. Site Visits - Site visits conducted by USAID project office staff either alone or in conjunction with ISRA counterparts provide another means to monitor progress. As the emphasis of this project will be upon farm-level research and farmer participatory research, field visits become an important means of supplementing formal reports on project performance.

3. Farmer Groups/NGO's - To the extent possible, additional field level monitoring will be done with the direct involvement of the beneficiaries themselves as represented by either farmer groups or NGO/farmer representatives.

4. Annual Work and Financial Plans- The annual workplans will establish specific targets and dates for project-level interventions. USAID will monitor the annual workplan against annual objectives. However, it is possible to complete all specific objectives for the annual workplan without having impact upon the overall program goal.

Annual Joint Review: The joint review brings together senior Mission management and GOS officials and key staff to review project progress in the field. The annual joint reviews will assess progress at both the project level and the programmatic level.

Other Means of Monitoring at the Project Level:

Audits - This project provides for a rigorous audit schedule with audits planned beginning in year three and annually thereafter. Audits will be conducted by a private accounting firm in accordance with A.I.D. regulations. Audits will focus upon the financial management and accounting systems set up for the project by the technical assistance team.

Program Level Indicators:

The Mission has committed itself to careful program level monitoring of this project. The data to be gathered link not only to the Mission's CPSP but will form an integral part of the overall API reporting which is done annually. It is important to refine the indicators therefore to be monitored at the program level. The MSI ARIIM provides an excellent framework for this programmatic review.

Their work defined four levels of indicators for agricultural research:

Level I: Institutional Base - to assess the institutional capability and capacity;
Level II: technology Generation and Transfer - assessing the rate and quality of technology developed;
Level III: Intermediate Impact - measuring progress made in generation and transfer; and
Level IV: Long-Term Impact - extent to which the Development Fund for Africa (DFA) objectives have been met.

This section, referred to as "program Level" identifies a number of indicators which merit consideration in the development of a NRBAR-specific set of indicators. It develops a set of short and medium-term proxies for measurement of the relationship between project inputs and outputs linked to purpose level objectives. In arriving at these preliminary indicators (to be refined during year one of the project), the design team is indebted to the authors of the Management Systems Incorporated January, 1991 paper on Agricultural Research Impact Indicators Matrix (ARIIM) for establishing a framework for review of possible agricultural research project indicators. The design team concurs fully with the need to monitor the project at each of the four levels indicated in the ARIIM - the institutional base, the technology generation and transfer base, the intermediate impact and the long-term impact levels. In order to narrow the list to a moderate number of indicators, Senegal and ISRA-specific indicators have been preliminarily identified as appropriate for the monitoring of natural resources based agricultural research technology. The following are illustrative of the types of indicators have been developed for each level as follows:

ILLUSTRATIVE BASELINE INDICATORS

Level I - Institutional Base: The following questions are provided to the contract technical assistance team to guide their development of a baseline study. These, or similar questions, will be answered and progress against these indicators measured to serve as a means of verifying impact at the institutional level:

1. What is ISRA's current capacity to plan, manage agricultural research?

(a) adequacy of linkages with other national research institutions;
(b) adequacy (number, gender representation, quality) of contact, contracts and protocols with extension, NGO/PVO's private sector, farmers' groups;
(c) organizational structure: personnel plan, revised procedures, research plans tied to annual budget and manpower plan.

2. What are ISRA's current Human and Financial Strengths?

(a) research budget by category and changes registered over time;
(b) numbers and training levels of researchers and staff; turnover; and gender;
(c) financial management assessment (budget line items as percents of total, as percents of agricultural GDP, financial planning, internal control systems and budgeting);
(d) research station level staffing, ratio of technicians to scientists.
(e) donor coordination on financing;
(f) maintenance of GOS support;

Level II - Technology Generation and Transfer:

What is the Output and Rate of Generation of Technology?

(a) number and variety of "menu" technologies developed with farmer participation and offered to extension services or farmers;
(b) ratio of these technologies which respond to specific NRM issues and to regional differences;
(c) source of technologies (domestic programs, regional, IARCs).

Level III - Intermediate Impact Level: Farmer-level adoption is important in assessing the adequacy of "fit" of the technologies generated. While some research station-level data will be gathered and analyzed for agronomic research purposes, the project will also measure the number of farmer adopters, the rate of adoption, and their adaptation of the technology for their own purposes. The following seeks to assess the technology from the farmers' perspective.

What are the scope and level of Adoption?

(a) number of technologies adopted by type (specify);
(b) completeness of adoption of each technology;
(c) farmer assessment of technology (yield, disease resistance, shorter maturity, sustainability, taste, etc.); by gender;
(d) % of land under technology at individual farmer level;
(e) % of village land under technology;
(f) number of farmers adopting by type of technology, by farm size and by gender.
(g) soil or water problems impeding adoption;
(h) sufficiency of supply of purchased inputs required;
(i) labor constraints;
(j) other (specify).

Level IV - Long-term Impact Level:

1. What have been the changes on Agricultural Productivity?

(a) change in yield, stability of yield, change in gross value of production;
(b) contribution of tree products or animal products to net farm income;
(c) impact upon on-farm investment 'soil conservation, live or dead fencing, windbreaks, contour bunds);
(d) cropping intensity (animal mechanization, solid cultivation, weed control, planting dates);
(e) technology related shift in farming systems (inter-cropping, alley cropping, use of organic matter).

2. What have been the Impacts Upon the Resource Base?

(a) changes in land use, farm size;
(b) percent of land with increased forest cover;
(c) erosion/sedimentation measurement.

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II. EVALUATION PLAN

The NRBR project will have a seven-year life. Two external evaluations are planned during this period, one after year four of the project and a final project evaluation. Baseline data for these evaluations will include the project logframe or logframes, if amended, the baseline data gathered during year one of the project, the annual reports and annual plans issued by the project, and the annual research program reports issued by ISRA. The evaluation team will review these documents, interview USAID and ISRA staff and conduct field visits to research stations and to villages to assess the project's progress and its impact. The evaluation conducted after year four of the project, a "mid-term" evaluation, will measure progress in achieving the project purpose as well as assessing the need for modifications to the project to ensure project success or sustainability. An important component of the mid-term evaluation will be the evaluation team's assessment of the extent that project-financed financial management, administration, research planning and research management activities have measurably strengthened ISRA as an institution.

The final project evaluation will determine the success of the project in generating and facilitating the adoption of NR-based technologies by villagers (male and female and the distinctive impact which may be measured), the impact these technologies have had upon agricultural production, income, and the natural resource base, the sustainability of the technologies introduced, and the further need, if any, for continued support to agricultural research in Senegal, including institutional strengthening.

VIII. Conditions and Covenants

Except as USAID may otherwise agree in writing, prior to the initial disbursement under the Grant, or to the issuance by USAID of documentation pursuant to which disbursement will be made, the Grantee will furnish to A.I.D. in form and substance satisfactory to A.I.D.

1. A statement of the name of the person(s) holding or acting on behalf of the Government of Senegal and of any additional representatives, together with a specimen signature of each person(s) specified in such statement.

2. A statement listing the names of ISRA officials designated to act as project director, assistant director and grants coordinator for the project.

The project grant agreement will also contain the following special covenants:

1. The GOS agrees to establish in conjunction with USAID an evaluation program as part of the project. The evaluation program will include:

a. evaluation of progress toward attainment of the objectives of the project;

b. identification and evaluation of problems areas or constraints that inhibit attainment of project objectives;

c. assessment of how such information may be used to overcome problems;

d. evaluation, to the extent feasible, of the overall development impact of the project.

2. The GOS agrees to provide, by January 1992, office space and furniture to meet the needs of the technical assistance team.

3. ISRA agrees to hold an annual workplan review with NGOs, farmer associations, private institutions, extension agencies and other partners collaborating in its natural resources-based research program to review its annual plans.

4. ISRA agrees to develop protocols for farmer participatory research on natural resources-based agricultural technologies with NGOs, farmer associations, private institutions and extension agencies to implement activities outlined in its annual workplan review.

6. GOS agrees to obtain a commitment from long-term participant trainees that, upon completion or return from their degree programs, they agree to work at ISRA for a period of time equal to that of their training.

MLK/mmd 9/7/91

REPUBLIQUE DU SENEGAL

MINISTERE
DE L'ECONOMIE, DES FINANCES
ET DU PLAN

DIRECTION DE LA DETTE
ET DES INVESTISSEMENTS

N° 7599 /M.E.F.P./D.D.I.

ANNEX A

Dakar, le 25 JUIL. 1991

Le Ministre

Date Rec'd 25 JUIL. 1991
MIN N° 2702
Action Taken .....
Date .....
Signature .....

OBJET : Financement du projet de recherche agricole basé sur les ressources naturelles.

REFERENCE : V/L A.I.D./PRM/91-049 du 3 juillet 1991.

Monsieur le Directeur,

Je vous confirme par la présente que le gouvernement du Sénégal souhaite poursuivre la coopération avec les Etats-Unis d'Amérique dans le cadre du projet en objet pour lequel l'USAID se propose d'apporter un financement d'un montant global de 19.750.000 dollars américains sur sept ans.

Je vous informe que ce projet, qui fait l'objet de négociations avancées entre l'USAID et l'Administration sénégalaise par le biais de l'ISRA, a reçu l'approbation du ministère de l'Economie, des Finances et du Plan et est placé sous la tutelle du ministère du Développement rural et de l'Hydraulique.

Je vous prie de croire, Monsieur le Directeur, à l'assurance de ma considération distinguée.

Le Ministre de l'Economie, des Finances et du Plan

Famara Ibrahima SAGNA

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Monsieur Julius E. COLES
Directeur USAID/Sénégal

DAKAR

ANNEX B

ACTION: AID INFO: EXEC RIG ECON

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DIST: AID

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AIDAC ABIDJAN FOR S.K. REDDY

E.O. 12356: N/A
TAGS:
SUBJECT: NATURAL RESOURCES-BASED AGRICULTURE RESEARCH PROJECT (685-0285), ECPR GUIDANCE.

1. THE ECPR MET ON APRIL 5 TO REVIEW THE SUBJECT PROJECT PID. THE MEETING WAS CHAIRED BY JOHN HICKS, DIRECTOR, OFFICE OF SAHEL WEST AFRICA. THE MEETING WAS ATTENDED BY REPRESENTATIVES OF AFR/SWA, AFR/PD, AFR/DP, AFR/TR, GC/AFR, PPC/WID, AND BIFAD. THE MISSION WAS REPRESENTED BY DIRECTOR COLES, AS WELL AS RICHARD GREEN AND ROD KITE. THE PID WAS APPROVED. THE MISSION SHOULD PROCEED WITH PROJECT DESIGN AND IS DELEGATED AUTHORITY TO AUTHORIZE THE PROJECT SUBJECT TO THE GUIDANCE BELOW AND AID/W APPROVAL OF IMPLEMENTATION ARRANGEMENTS.

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2. ISSUE NO. 1. WHAT IS THE APPROPRIATE PROJECT PURPOSE AND IS A RESEARCH APPROACH THE MOST EFFECTIVE MEANS FOR ACHIEVING THE PURPOSE?

UNDER THE DFA MANDATE TO MORE CLOSELY RELATE PROJECT INVESTMENTS TO IMPACTS, REVIEWERS FELT THAT A MORE APPROPRIATE PURPOSE IS ONE OF INCREASING USE OF IMPROVED NATURAL RESOURCE TECHNOLOGIES THAT ENHANCE AGRICULTURAL PRODUCTIVITY, ESPECIALLY SINCE THE PID NOTES THAT A NUMBER

OF THE TECHNOLOGIES ALREADY EXIST AND NEED ONLY FIELD VERIFICATION AND REPACKAGING TO INCREASE ADOPTION.

IN LINE WITH A PROPOSED MORE AMBITIOUS PURPOSE, THE PROJECT COMMITTEE QUESTIONED WHETHER THE GREATEST CONSTRAINT TO ADOPTION OF KNOWN TECHNOLOGIES IS SOME FACTOR OTHER THAN RESEARCH. THE PID INDICATES THAT A NUMBER OF NATURAL RESOURCES-BASED TECHNOLOGIES CAPABLE OF INCREASING SOIL FERTILITY AND PRODUCTIVITY ARE ALREADY IN USE ON FARMERS' FIELDS, WHILE OTHERS ARE AVAILABLE, BOTH IN SENEGAL AND IN OTHER SAHEL COUNTRIES. BUT THE PID DOES NOT EXPLAIN WHY THEIR USE IN SENEGAL IS NOT SPREADING. FURTHER, THE LINKAGE BETWEEN ADAPTIVE RESEARCH AND THE NECESSARY INSTITUTIONAL/POLICY ENVIRONMENT TO MAKE UTILIZATION LIKELY IS NOT EXPLAINED.

CONSEQUENCE. THE MISSION SHOULD CONSIDER A MORE AMBITIOUS

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PROJECT PURPOSE, AS DISCUSSED ABOVE. THE PP SHOULD JUSTIFY WHY PROJECT ASSISTANCE IN NRMS IS TIMELY GIVEN OTHER CONSTRAINTS RANGING FROM WEAK EXTENSION SERVICES TO POOR POLICIES IN SOME AREAS; PUT THE OPPOSITE WAY, WHAT IS NOW CHANGING (E.G. WHICH POLICIES, PRICE MOVEMENTS, ETC.) THAT MAKES INVESTMENT IN NATURAL RESOURCES ADAPTIVE RESEARCH LIKELY TO YIELD A HIGHER RETURN?

EMPHASIS IN PROJECT DESIGN SHOULD BE ON MODIFYING OR REPACKAGING EXISTING TECHNOLOGIES SO THAT COMPLEMENTARY CHARACTERISTICS ARE INCORPORATED/ATTACHED. THEREFORE THE INTERVENTION MIGHT BE LESS ONE OF RESEARCH THAN ONE OF DOCUMENTING TECHNOLOGIES AND DEVELOPING STRATEGIES FOR EFFECTIVELY DISSEMINATING INFORMATION OR TECHNICAL PACKAGES TO PUT THEM TO USE. GIVEN THE OVERLAP WITH EXTENSION ISSUES, THE MISSION SHOULD CONDUCT A FULLER ASSESSMENT OF CURRENT EXTENSION SERVICES (INCLUDING NON-GOS ENTITIES SUCH AS NGOS AND FARMER ORGANIZATIONS) AND EXAMINE HOW THESE SERVICES CAN BE STRENGTHENED THROUGH THIS PROJECT, OR WITH LOCAL CURRENCY FUNDING FROM THE PROSPECTIVE AGRICULTURE SECTOR GRANT.

3. ISSUE NO. 2. GIVEN THE CURRENT STATE OF ISRA AND ITS DEPENDENCE ON A VARIETY OF DONOR SUPPORT, IS IT TIMELY TO INITIATE A NEW ISRA RESEARCH PROGRAM IN NATURAL RESOURCES?

THE PID AND THE RECENT AGRICULTURE SECTOR ANALYSIS INDICATE THAT WITH THE ENCOURAGEMENT OF THE DONORS ISRA HAS BEGUN A PROCESS OF IMPROVING ITS OVERALL MANAGEMENT. ALTHOUGH AS A PERCENTAGE OF AGRICULTURE-BASED GDP SENEGAL'S INVESTMENT IN AGRICULTURE RESEARCH IS SUBSTANTIAL AT AROUND ONE PERCENT. THE SECTOR ANALYSIS

POINTS OUT THAT THESE FUNDS HAVE BEEN INADEQUATE TO MEET EVEN SALARY COSTS. DURING THE NEXT SEVERAL YEARS MORE THAN HALF OF ISRA'S FINANCING WILL COME FROM DONORS, BUT STILL NEARLY 20 PERCENT OF ITS CURRENT FIVE-YEAR PLAN IS UNDERFINANCED, AND ACCORDING TO THE ANALYSIS, RESEARCH STATIONS AND FACILITIES ARE DETERIORATING STEADILY. THIS REFLECTS AN APPARENT IMBALANCE BETWEEN CURRENT/PLANNED DONOR INVESTMENT IN SPECIFIC RESEARCH PROGRAMS AND GOS FUNDING FOR RECURRENT ISRA COSTS. DESPITE THE STEPS THAT ISRA HAS TAKEN TO REDUCE RECURRENT COSTS THROUGH STAFF RETRENCHMENT, A FINANCING GAP CONTINUES AND WOULD APPEAR TO BE EXACERBATED WHEN A NEW RESEARCH AGENDA IS IMPOSED ON ISRA WITHOUT ELIMINATING SOME OTHER ASPECT OF ITS RESEARCH PROGRAM.

THIS PROJECT PROPOSES EXPENDITURE OF $1 MILLION PER YEAR

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BE PAID BY ISRA AFTER THE PACD? SOME STEPS HAVE ALSO BEEN TAKEN TO BETTER FOCUS THE ISRA RESEARCH AGENDA. BUT AS THE RECENT ANALYSIS STATES, THE PLAN HAS BEEN OVERTAKEN BY A FINANCIAL CRISIS AND DOMESTIC POLITICAL PRESSURE FOR REFORM. MOREOVER, THE PLAN ITSELF DOES NOT ACTUALLY INDICATE A SERIOUS NARROWING OF THE WIDESPREAD ISRA PROGRAM. OF PARTICULAR CONCERN TO THE PROJECT COMMITTEE IS THAT ONLY THREE PERCENT OF THE DIRECT COSTS OF THE NATIONAL RESEARCH PROGRAM BUDGET IS ALLOCATED TO PEANUTS AND ONLY EIGHT PERCENT TO COARSE GRAINS (EXCLUSIVE OF PADDY RICE), DESPITE THE PROMINENCE OF THESE CROPS IN SENEGAL, AND THAT THERE ARE FEW RESEARCHERS AND ONLY ONE RESEARCH STATION NOW ENGAGED IN NRMS ISSUES.

THE PROJECT COMMITTEE RECOGNIZES THAT ISRA IS THE ONLY SENEGALESE AGRICULTURAL RESEARCH INSTITUTION WITH SIGNIFICANT CAPABILITY, AND CONTINUED IMPROVEMENT OF ITS CAPACITY WILL CONTINUE TO BE IMPORTANT FOR SENEGAL'S DEVELOPMENT. NONETHELESS, THERE IS A CONCERN THAT, IN ADDITION TO THE VALUE IN ITS OWN RIGHT OF THE SPECIFIC RESEARCH PROPOSED, THIS NEW PROJECT BE PART OF ISRA'S INSTITUTIONAL SOLUTION RATHER THAN CONTRIBUTE OVER THE LONGER RUN TO THE PROBLEM OF POOR MANAGEMENT, BUDGETING, STRATEGIC PLANNING, AND DEPENDENCE ON DONOR FUNDING AND PRIORITIES.

GUIDANCE. BEFORE USAID IMPLEMENTS A NATURAL RESOURCES RESEARCH PROGRAM IN SENEGAL, THE DONOR COMMUNITY AND ISRA SHOULD TAKE FURTHER STEPS TO ESTABLISH A CLEAR SET OF PRIORITY RESEARCH OBJECTIVES AND RELATED IMPLEMENTATION PLANS AND BUDGETS. SUCH STEPS SHOULD BE DESCRIBED IN THE PP. THE MISSION SHOULD EXAMINE WAYS TO STRENGTHEN ISRA/GOS COMMITMENT TO REFORM THROUGH SPECIFIC CONDITIONALITY/COVENANTS IN THE PROJECT, BUILDING ON THE LEVERAGE FROM ALL OF THE MISSION'S INVESTMENTS IN AGRICULTURE, INCLUDING THE PROPOSED AGRICULTURE SECTOR GRANT NPA. THE MISSION SHOULD ALSO CONSIDER INCREASING THE LEVEL OF ASSISTANCE FOR OVERALL ISRA MANAGEMENT RATHER THAN CONCENTRATE MOST MANAGEMENT ASSISTANCE ON THE AID-FUNDED NATURAL RESOURCES COMPONENT OF THE ISRA AGENDA. THE PP SHOULD EXPLAIN WHERE THE MISSION EXPECTS ISRA TO BE WITH RESPECT TO INSTITUTIONAL CAPACITY AND GOS COVERAGE OF RECURRENT COSTS BY PACD.

cond. of WB yes + general conditions in prog

4. ISSUE NO. 3: SHOULD FUNDS BE RESERVED FOR RESEARCH GRANTS AND PROTOCOLS WITH NON-GOVERNMENT ORGANIZATIONS, FARM ORGANIZATIONS, AND INPUT SUPPLIERS. AND HOW CAN THIS FUNDING BE MOST DEMAND-DRIVEN?

THE PROJECT SETS ASIDE $2.5 MILLION FOR GRANTS TO THESE ORGANIZATIONS. THE PROJECT COMMITTEE WAS CONCERNED THAT THIS APPROACH IMPLIED THAT THE CLIENT FOR THE RESEARCH IS

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A PUBLIC SECTOR ENTITY (ISRA OR, MORE BROADLY SPEAKING, THE GOS). THIS RAISES CONCERNS WITH REGARD TO THE "OWNERSHIP" OF THE RESEARCH AGENDA (THE GOS OR THE END USERS OF THE RESEARCH?), AS WELL AS THE COST-EFFECTIVENESS AND QUALITY OF RESEARCH CARRIED OUT BY ORGANIZATIONS NOT CONSTITUTED FOR AGRICULTURAL RESEARCH PURPOSES.

THE MISSION INDICATED THAT IT WAS WELL AWARE OF TWO U.S. ORGANIZATIONS -- WINROCK AND RODALE -- CONDUCTING QUALITY INNOVATIVE ADAPTIVE RESEARCH IN SENEGAL AND THAT AT LEAST TWO OTHERS EXIST. THE COMMITTEE WAS LESS CONCERNED WITH FUNDING THESE ORGANIZATIONS THAN WITH FUNDING COMMUNITY ORGANIZATIONS NOT CONSTITUTED OR QUALIFIED TO CONDUCT RESEARCH.

WHILE THE COMMITTEE FOUND THE GENERAL APPROACH OF ENGAGING QUALIFIED NON-GOVERNMENT ENTITIES TO UNDERTAKE RESEARCH AN ATTRACTIVE FEATURE OF THE PROJECT, IT WAS CONCERNED THAT THE IMMEDIATE GAINS FROM FUNDING THIS DECENTRALIZED APPROACH NOT BE AT THE COST OF UNDERMINING ISRA'S LIMITED CAPACITY. ONE APPROACH DISCUSSED FOR STRENGTHENING ISRA'S RESPONSIVENESS TO FARMER NEEDS WOULD BE TO ESTABLISH PROTOCOLS FOR THE PRIVATE SECTOR TO CONTRACT WITH ISRA TO CONDUCT RESEARCH OF PARTICULAR INTEREST TO THE PRIVATE SECTOR. THIS WOULD LEAD TO BETTER DOWN STREAM LINKAGES

WITH THE END USERS, SO THAT TECHNOLOGIES AND END PRODUCTS ARE BETTER UTILIZED. THIS WOULD ALSO OPEN THE RESEARCH ESTABLISHMENT TO ADDRESSING ISSUES AND PROBLEMS OF SPECIALIZED INTEREST, INCLUDING HIGH-VALUE CROPS, THAT MAY OPEN PRODUCTION OPPORTUNITIES FOR MANY OTHER GROWERS. UNDER THIS PROJECT NGOS COULD BE SUPPORTED FOR THE DEVELOPMENT OF LINKAGES WITH PROCESSORS AND OTHER PRIVATE AGENTS THAT COULD MULTIPLY OR PRODUCE NEW TECHNOLOGY FOR

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DISTRIBUTION.

GUIDANCE. 1) FUNDING FOR NON-ISRA ENTITIES TO CARRY OUT [illegible] SHOULD BE STRICTLY LIMITED TO PROPOSALS CONSISTENT WITH THE PROJECT PURPOSE AND SHOULD BE ISSUED ONLY AFTER AN INSTITUTIONAL ANALYSIS OF THE GRANTEE THAT CONCLUDES THAT IT HAS THE TECHNICAL CAPACITY, KNOWLEDGE OF SENEGALESE AGRICULTURE/NATURAL RESOURCE ISSUES, AND ESTABLISHED LINKS WITH SENEGALESE EXPERTS AND/OR COMMUNITIES THAT PROMISE GREATER PROGRAM SUSTAINABILITY; 2) THE MISSION SHOULD EXAMINE VARIOUS OPTIONS, SUCH AS A PUBLIC/PRIVATE RESEARCH COUNCIL, TO REVIEW RESEARCH PROPOSALS; 3) SUPPORT TO OTHER NGOS SHOULD BE LIMITED TO PARTICIPATION IN SETTING RESEARCH AGENDAS AND IN TECHNOLOGY TRANSFER; AND, 4) DURING PP DESIGN THE MISSION SHOULD STUDY THE VIABILITY OF FUNDING NGOS AND FARMER ORGANIZATIONS TO CONTRACT WITH ISRA AND SUCH ORGANIZATIONS AS WINROCK AND RODALE TO CONDUCT SPECIFIC RESEARCH/TRIALS. THE ARRANGEMENTS FOR IMPLEMENTING THIS PROJECT COMPONENT SHOULD BE FULLY DESCRIBED IN THE PP.

5. ISSUE NO. 4: WOULD IT BE BENEFICIAL TO THE LONG-TERM INSTITUTIONAL DEVELOPMENT OF ISRA TO OFFER RESEARCH GRANTS TO ISRA EMPLOYEES TO CONDUCT RESEARCH AT ISRA? WOULD SUCH GRANTS CONSTITUTE "SALARY SUPPLEMENTS"?

THE PROJECT PROPOSES TO PROVIDE NEARLY $1,000,000 OVER THE LOP FOR INNOVATIVE PROPOSALS SUBMITTED BY SCIENTISTS FROM ISRA AND OTHER INSTITUTIONS FOR RESEARCH ON NATURAL RESOURCESBASED TECHNOLOGIES, FOR RESEARCH ASSISTANTS STUDYING RESOURCE MANAGEMENT ISSUES IN SENEGAL, AND FOR ISRA STAFF APPLYING FOR SABBATICALS TO WORK ON RESEARCH RELATED TO THE PROJECT OBJECTIVES. SEVERAL MEMBERS OF THE PROJECT COMMITTEE QUESTIONED WHETHER THIS WOULD BE APPROPRIATE FOR ISRA STAFF AND WHETHER SUCH GRANTS MIGHT TEND TO UNDERMINE ISRA'S RESEARCH AGENDA BY ATTRACTING RESEARCHERS AWAY FROM OTHER PRIORITY RESEARCH PROJECTS? THE MISSION CLARIFIED THAT THEY WOULD EXPECT THE GRANTS TO BE USED TO FUND SOMETHING AKIN TO A SABBATICAL WHERE THE RESEARCHER IS OFF THE ISRA PAYROLL.

GUIDANCE. THIS ELEMENT OF THE PROJECT SHOULD BE DESIGNED SO THAT, AS WITH GRANTS TO ORGANIZATIONS, GRANTS TO INDIVIDUALS ARE CLOSELY RELATED TO THE PROJECT PURPOSE. THE MISSION SHOULD CONSULT WITH THE RLA/DAKAR AND ADDRESS THE SALARY SUPPLEMENT ISSUE IN THE PP.

6. ISSUE NO. 5: HOW SHOULD THE PROJECT BE IMPLEMENTED?

THE TITLE XII CONTRACTING MODE HAS BEEN ESTABLISHED AS AGENCY POLICY FOR AGRICULTURAL RESEARCH PROGRAMS. THIS PROJECT WOULD ORDINARILY BE FUNDED THROUGH TITLE XII IN FURTHERANCE OF THE GUIDANCE. THE PID PROPOSES NOT USING TITLE XII BUT DOES NOT PRESENT AN ARGUMENT FOR AN EXCEPTION TO THE TITLE XII POLICY. THE MISSION HAS SUBSEQUENTLY STATED THAT IT PREFERS NOT USING TITLE XII IN ORDER TO ATTRACT INTEREST FROM NON-TITLE XII INSTITUTIONS THAT HAVE SPECIALIZED EXPERIENCE IN LOW-COST APPROPRIATE

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TECHNOLOGY APPROACHES TO ENHANCING SOIL PRODUCTIVITY

BIFAD'S POSITION IS THAT THIS SHOULD BE A TITLE XII PROCUREMENT. IN ORDER TO MAXIMIZE THE MISSION'S CONTROL OF THE SUPPORT TO ISRA, BIFAD SUGGESTS THAT THE MISSION DESIGN THE PROJECT (RATHER THAN A COLLABORATIVE DESIGN) AND THAT THE TERMS OF REFERENCE FOR IMPLEMENTATION ENCOURAGE TITLE XII APPLICANTS TO TEAM UP WITH NON-UNIVERSITY ENTITIES WITH THE SPECIALIZED EXPERIENCE APPROPRIATE FOR THIS PROJECT.

ANOTHER IMPLEMENTATION OPTION ALTOGETHER WOULD BE TO RELY ON CENTRALLY OR REGIONALLY FUNDED RESEARCH ACTIVITIES - THE CRSPS (COLLABORATIVE RESEARCH SUPPORT PROGRAMS) AND THE IARC (INTERNATIONAL AGRICULTURE RESEARCH CENTERS) REGIONAL NETWORKS -- FOR TECHNICAL ASSISTANCE. THESE ORGANIZATIONS ARE ALREADY REPRESENTED IN THE REGION AND KNOW THE ACTORS IN ISRA, AS WELL AS THE TECHNICAL ISSUES THROUGHOUT THE SAHEL AND FOR SIMILAR CLIMATES WORLDWIDE. THE CRSPS REPRESENT U.S. TITLE XII INSTITUTIONS. IN THIS SCENARIO, TECHNICAL ASSISTANCE FROM THESE INSTITUTIONS WOULD BE PRIMARILY SHORT-TERM AND LESS COSTLY THAN USING A LARGE CONVENTIONAL TECHNICAL ASSISTANCE TEAM.

GUIDANCE. THE MISSION SHOULD FURTHER EXAMINE THE THREE IMPLEMENTATION OPTIONS OUTLINED ABOVE. PRIOR TO FINALIZING THE PP, THE PREFERRED IMPLEMENTATION APPROACH AND JUSTIFICATION SHOULD BE SUBMITTED FOR AID/W REVIEW AND APPROVAL.

7. MONITORING RESEARCH IMPACTS. IT IS NOTED IN THE PID THAT GUIDANCE WILL NEED TO BE PROVIDED ON APPROPRIATE

MECHANISMS TO BUILD INTO THE PROJECT TO MONITOR RESEARCH

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IMPACTS. WHILE PARTICULAR ATTENTION WILL BE NEEDED TO MONITOR THE IMPACT THAT PROJECT INVESTMENT WILL HAVE ON AGRICULTURE PRODUCTIVITY, IT IS IMPORTANT TO INCORPORATE THIS CONCERN INTO THE INSTITUTIONAL DEVELOPMENT APPROACH THAT IS BEING PROMOTED WITH ISRA. HENCE THE BROADER ISSUE IS WHETHER THE MANAGEMENT AND INSTITUTION BUILDING ASPECTS OF THE PROJECT INCORPORATE CONCERNS FOR MONITORING THE IMPACT OF RESEARCH EFFORTS. AT THE PROJECT OUTPUT LEVEL THE PROJECT SHOULD INCLUDE THE DEVELOPMENT OF MONITORING AND EVALUATION CAPACITY TO ASSESS AND DOCUMENT THE IMPACT OF THE AGRICULTURAL RESEARCH THAT WILL BE FUNDED. AFR/TR HAS DEVELOPED CONCEPTUAL MODELS FOR BOTH AGRICULTURE RESEARCH AND NRMS THAT COULD BE OF ASSISTANCE TO THE MISSION.

8. GENDER ISSUES. IT IS NOT CLEAR HOW RESEARCH AND EXTENSION STRATEGIES WILL TAKE ACCOUNT OF GENDER ROLES IN SOCIETY. IT MAY NOT BE POSSIBLE TO ADEQUATELY ADDRESS THE PROJECT'S EFFECTIVENESS IN MEETING FARMERS' TECHNICAL NEEDS IF GENDER DISAGGREGATED DATA ON ADOPTORS ARE NOT INCORPORATED. THE MISSION IS THEREFOR REMINDED TO 1) ESTABLISH GUIDELINES THAT ENSURE WOMEN ARE INVOLVED IN THE RESEARCH PROCESS; 2) ESTABLISH TARGETS FOR PERCENTAGE OF TRAINING PARTICIPANTS WHO ARE WOMEN; AND, 3) ENSURE ALL INDICATORS ARE GENDER DISAGGREGATED. PPC/WID CAN ASSIST IN IDENTIFYING AND FUNDING DESIGN EXPERTISE IN THIS AREA.

9. HOST COUNTRY CONTRIBUTION. IN THE EVENT THE AGRICULTURE SECTOR GRANT IS NOT APPROVED OR FUNDS NOT DISBURSED BEFORE FINAL PP DESIGN, THE PP MUST INCLUDE A DISCUSSION ON HOW THE HOST COUNTRY CONTRIBUTION REQUIREMENT (APPROXIMATELY $6.4 MILLION BASED ON THE PROPOSED LOP) WILL BE MET.

AS AN ALTERNATIVE, BASED ON FURTHER ANALYSIS FOLLOWING THE FCPR MEETING IT WOULD APPEAR THAT A WAIVER OF THE CONTRIBUTION COULD BE CONSIDERED. THE REPEAL OF FAA SECTION 121, COUPLED WITH THE NEW DFA LEGISLATION WHICH NOTES THAT ANY REFERENCE IN ANY LAW TO CHAPTER 1 OF THE FAA (INCLUDING REFERENCES TO SECTIONS 103 THROUGH 106) IS TO BE DEEMED TO BE A REFERENCE TO THE DFA, RESULT IN THE REQUIREMENT FOR A.I.D. MISSIONS IN SAHEL COUNTRIES TO ADDRESS FAA SECTION 110. ALTHOUGH THE ECONOMIC ANALYSIS MENTIONS THAT SENEGAL IS CONSIDERED BY THE WORLD BANK TO BE A MIDDLE INCOME COUNTRY, WE BELIEVE A WAIVER OF THE REQUIREMENTS OF SECTION 110 MAY BE CONSIDERED. A.I.D. HANDBOOK 3, CHAPTER 2, APPENDIX 2G ("RECIPIENT COUNTRY CONTRIBUTION TO THE ACTIVITY"), NOW INCLUDES AS ELIGIBLE

FOR WAIVER CONSIDERATION THOSE COUNTRIES ON THE DEVELOPMENT ASSISTANCE COMMITTEE ("DAC") LIST OF "LOW INCOME COUNTRIES." INASMUCH AS SENEGAL IS INCLUDED ON THE MOST RECENT DAC LIST AVAILABLE TO AID/W (SEE TABLE 64 OF THE 1990 DAC "DEVELOPMENT CO-OPERATION" REPORT), THE MISSION MAY REQUEST A WAIVER OF THE COUNTRY CONTRIBUTION REQUIREMENT. FOR FURTHER GUIDANCE, SEE HB 3, APPENDIX 2G.

10. PROCUREMENT POLICY.MISSION IS REMINDED TO INCLUDE

DISCUSSION OF COMPLIANCE WITH GRAY AMENDMENT IN ITS PROCUREMENT PLAN.

11. DESIGN TEAM. UNLIKE MANY RESEARCH PROJECTS, HERE THE SPECIFIC TECHNOLOGIES TO BE FURTHER STUDIED ARE LARGELY BASED ON CURRENT INDIGENOUS PRACTICES. THE MISSION SHOULD CONSIDER INCLUDING AN ANTHROPOLOGIST OR RURAL SOCIOLOGIST TO EXAMINE SOCIAL/CULTURAL FACTORS ASSOCIATED WITH THESE TECHNOLOGIES, AND TO PARTICIPATE IN DESIGNING THE TECHNICAL ASSISTANCE SUPPORT NECESSARY TO EFFECT BROADER APPLICATION OF SUCH TECHNOLOGIES. EAGLEBURGER
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OR GFRHY OWEIS, BIFAD FROM JULIUS E. COLES, DIR.

.O. 12356: N/A
UBJECT: CONTRACTING FOR NATURAL RESOURCES-BASED
GRICULTURAL RESEARCH PROJECT (685-0285)

EF: STATE 130946

. REFTEL PARA 6 ASKED MISSION TO EXAMINE THREE OPTIONS
OR IMPLEMENTATION OF THE TECHNICAL ASSISTANCE UNDER THE
ATURAL RESOURCES-BASED AGRICULTURAL RESEARCH PROJECT AND
O SUBMIT OUR PREFERRED IMPLEMENTATION APPROACH AND
USTIFICATION TO AID/W FOR APPROVAL. WE HAVE DISCUSSED
OSSIBLE APPROACHES BOTH WITHIN THE MISSION AND WITH ISRA
ND ARE SUBMITTING OUR POSITION AND JUSTIFICATION IN THIS
ABLE FOR YOUR CONCURRENCE.

2. WE ACCEPT BIFAD'S POSITION, STATED REFTEL, THAT
ECHNICAL ASSISTANCE BE PROCURED THROUGH TITLE XII
ROCEDURES AND BIFAD'S SUGGESTION THAT THE TERMS OF
EFERENCE FOR IMPLEMENTATION ENCOURAGE TITLE XII
PPLICANTS TO TEAM UP WITH NON-UNIVERSITY ENTITIES FOR
PECIALIZED ASSISTANCE. WE WOULD LIKE TO GO FURTHER THAN
RIS, HOWEVER, TO REQUIRE, NOT SIMPLY ENCOURAGE, TITLE
II ENTITIES TO SUBMIT JOINT-PROPOSALS.

3. THE PLANNED PROJECT EMPHASIZES BUILDING ISRA'S
ANAGEMENT CAPACITY AS WELL AS RESEARCH. ISRA SUFFERS
ROM SEVERE MANAGEMENT PROBLEMS, INCLUDING PERSONNEL AND
INANCIAL MANAGEMENT AS WELL RESEARCH PLANNING. TITLE XII
NTITIES DO NOT HAVE CLEAR COMPARATIVE ADVANTAGE IN
INANCIAL AND INSTITUTIONAL MANAGEMENT. TECHNICAL
SSISTANCE IN FINANCIAL MANAGEMENT, FOR EXAMPLE, MIGHT
ETTER COME FROM A ACCOUNTING FIRM. NOR DO TITLE XII
NTITIES NECESSARILY HAVE A COMPARATIVE ADVANTAGE IN THE
YPE OF NATURAL RESOURCES-BASED AGRICULTURE RESEARCH
EING EMPHASIZED BY THE PROJECT. THIS TYPE OF RESEARCH
EQUIRES MAJOR FARMER PARTICIPATION AND ON-FARM RESEARCH,
GAIN AREAS WHERE TITLE XII ENTITIES, NORMALLY ASSOCIATED
ITH ON-STATION RESEARCH, MAY NOT BE AS STRONG AS PRIVATE
OLUNTARY ORGANIZATIONS OR PRIVATE COMPANIES.

4. THE MISSION RECOGNIZES THE STRENGTH OF TITLE XII
INSTITUTIONS IN AREAS OF IMPORTANCE TO THE PROJECT,
LINKAGES TO INT [illegible] AL AND NATIONAL RESEARCH
ORGANIZATIONS, [illegible] PLE, AND RESEARCH MANAGEMENT. IT

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WOULD WELCOME THE LEAD PARTICIPATION OF TITLE XII INSTITUTIONS AS PART OF A JOINT TECHNICAL ASSISTANCE TEAM COMPOSED OF PRIVATE SECTOR INSTITUTIONS OR NGOS. IT DOES NOT WANT TO RESTRICT BIDDING EXCLUSIVELY TO TITLE XII INSTITUTIONS, HOWEVER. TO DO SO WOULD WEAKEN THE POSSIBILITY OF A STRONG TEAM APPROPRIATE TO ISRA'S NEEDS.

5. WE PROPOSE, THEREFORE, TO USE TITLE XII PROCEDURES TO SOLICIT A JOINT PROPOSAL THAT COMBINES THE TALENTS OF A TITLE XII INSTITUTION, PRIVATE VOLUNTARY ORGANIZATION AND PRIVATE CONSULTING FIRM OR COMPANY. THE TERMS OF REFERENCE WILL CLEARLY LAY OUT AREAS SUCH AS FINANCIAL MANAGEMENT, DIRECT ON-FARM RESEARCH, PVO LIAISON, AGRO-FORESTRY, AND NATURAL RESOURCES MANAGEMENT WHERE WE THINK TITLE XII INSTITUTIONS SHOULD SEEK PARTNERS. OUR SCORING SYSTEM WILL REFLECT OUR INTEREST IN A TRULY JOINT PROPOSAL BETWEEN A XII INSTITUTION, AND PRIVATE SECTOR FIRM OR NGO.

6. PLEASE PROVIDE APPROVAL AS SOON AS POSSIBLE AS WE ARE IN THE PROCESS OF FINALIZING PROJECT PAPER. MOOSE

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CN: 43823
CHRG: AID
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E.O. 12356: N/A
TAGS:
SUBJECT: CONTRACTING FOR NATURAL RESOURCES-BASED AGRICULTURAL RESEARCH PROJECT (685-0285)

REF: DAKAR 05028

1. WE CONCUR WITH THE DECISION TO PROCURE THE TECHNICAL ASSISTANCE FOR THIS PROJECT THROUGH TITLE XII CONTRACTING PROCEDURES AND TO REQUIRE THE LEAD UNIVERSITIES TO COLLABORATE WITH QUALIFIED PRIVATE ENTITIES FOR IMPLEMENTING CERTAIN COMPONENTS OF THE PROJECT. HOWEVER, IN DEFINING WHO MUST IMPLEMENT WHAT FLEXIBILITY AND CREATIVITY SHOULD NOT BE IGNORED AND OFTEN TIMES IT IS DIFFICULT TO APPLY THE PRINCIPLE OF COMPARATIVE ADVANTAGE. EAGLEBURGER
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ANNEX C

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
GOAL: Increase cropping systems productivity in zones of reliable rainfall.	30,000 farmer families experiencing 50% increase in yields in the targeted zone primarily through the adoption of improved natural resources-based technologies ISRA-generated technology affecting 145,000 hectares.	Survey of adopters.	No serious post invasions, drought. - Price, resource tenure & other incentives do not discourage adoption.
PURPOSE: Generate tech. focusing upon resource mgt. practices which enhance productivity & sustainability of cereals-based cropping systems in zones of reliable rainfall.	On-farm validated technology developed capable of increasing cereals yields by 50%	ISRA research reports & bulletins.	-GOS and donor funding are adequate and stable. -World Bank financed extension project is effective in transferring technology from ISRA to farmers. -Farmer organizations are interested & capable (with assistance) of validating and disseminating technology and improved farming techniques.
OUTPUTS: 1. Effective, adaptive research program focusing upon cropping systems & resource management in the areas of: -soil & water management -forestry & agroforestry -improved cultural mgt practices for selected crops - millet, sorghum, corn, rice - applied economics program on production, marketing & policy issues relating to cereals-cropping systems.	15 technology systems validated for on-farm.	ISRA reports	
2. Improved research planning; improved research, financial & manpower management.	Research programs have clearly defined objectives achievable in medium term -System in place for periodically evaluating & revising research priorities & programs -Financial mgt system in place providing satisfactory accountability & control & producing useful info to mr. mgt. -Merit-based personnel evaluation & promotion system in place -Size & composition of ISRA staff aligned with research priorities & available resources.	-Reports by ISRA's Sci. & Tech.Committee -Reports by project research advisor -ISRA reports -Periodic project evaluations -Reports by project TA -Periodic project eval. -Periodic project audits -Contractor report -Periodic project evaluations -Contractor reports -Periodic evaluations	GOS approves and ISRA adopts internal reforms
3. Improved research-extension linkages, increasing feedback from farmers to ISRA on research results & from ISRA to farmers on appropriate and sustainable technologies.	ISRA collaborating w/ 15 PVO's, farmer organizations & ag input suppliers to evaluate technology -ISRA develops methods for enhancing role of farmers' organizations PVO's & private input suppliers in transferring improved technol. to farmers.	-ISRA records -Periodic evaluations	World Bank assistance to extension continues
4. Strengthened linkages with key international & domestic research institutions (on germ, cropping systems & adapted technologies)	Protocols w/ network collaborators clearly support ISRA's research priorities & define roles, responsibilities & resources.	Network evaluations. -Periodic project evaluations.	

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Check w/ Representative's Project Checklist.

5C(1) - COUNTRY CHECKLIST

Listed below are statutory criteria applicable to the eligibility of countries to receive the following categories of assistance: (A) both Development Assistance and Economic Support Funds; (B) Development Assistance funds only; or (C) Economic Support Funds only.

A. COUNTRY ELIGIBILITY CRITERIA APPLICABLE TO BOTH DEVELOPMENT ASSISTANCE AND ECONOMIC SUPPORT FUND ASSISTANCE

1. Narcotics

a. **Negative certification** (FY 1991 Appropriations Act Sec. 559(b)): Has the President certified to the Congress that the government of the recipient country is failing to take adequate measures to prevent narcotic drugs or other controlled substances which are cultivated, produced or processed illicitly, in whole or in part, in such country or transported through such country, from being sold illegally within the jurisdiction of such country to United States Government personnel or their dependents or from entering the United States unlawfully? NO

b. **Positive certification** (FAA Sec. 481(h)). (This provision applies to assistance of any kind provided by grant, sale, loan, lease, credit, guaranty, or insurance, except assistance from the Child Survival Fund or relating to international narcotics control, disaster and refugee relief, narcotics education and awareness, or the provision of food or medicine.) If the recipient is a "major illicit drug producing country" (defined as a country producing during a fiscal year at least five metric tons of opium or 500 metric tons of coca or marijuana) or a "major drug-transit country" (defined as a country that is a significant direct N/A

source of illicit drugs significantly affecting the United States, through which such drugs are transported, or through which significant sums of drug-related profits are laundered with the knowledge or complicity of the government):

(1) does the country have in place a bilateral narcotics agreement with the United States, or a multilateral narcotics agreement?

(2) has the President in the March 1 International Narcotics Control Strategy Report (INSCR) determined and certified to the Congress (without Congressional enactment, within 45 days of continuous session, of a resolution disapproving such a certification), or has the President determined and certified to the Congress on any other date (with enactment by Congress of a resolution approving such certification), that (a) during the previous year the country has cooperated fully with the United States or taken adequate steps on its own to satisfy the goals agreed to in a bilateral narcotics agreement with the United States or in a multilateral agreement, to prevent illicit drugs produced or processed in or transported through such country from being transported into the United States, to prevent and punish drug profit laundering in the country, and to prevent and punish bribery and other forms of public corruption which facilitate production or shipment of illicit drugs or discourage prosecution of such acts, or that (b) the vital national interests of the United States require the provision of such assistance?

c. Government Policy (1986 Anti-Drug Abuse Act of 1986 Sec. 2013(b)). (This section applies to the same categories of assistance subject to the restrictions in FAA Sec. 481(h), above.) If recipient country is a "major illicit drug producing country" or "major drug-transit country" (as defined for the purpose of FAA Sec 481(h)), has the President submitted a report to Congress N/A

listing such country as one: (a) which, as a matter of government policy, encourages or facilitates the production or distribution of illicit drugs; (b) in which any senior official of the government engages in, encourages, or facilitates the production or distribution of illegal drugs; (c) in which any member of a U.S. Government agency has suffered or been threatened with violence inflicted by or with the complicity of any government officer; or (d) which fails to provide reasonable cooperation to lawful activities of U.S. drug enforcement agents, unless the President has provided the required certification to Congress pertaining to U.S. national interests and the drug control and criminal prosecution efforts of that country?

2. **Indebtedness to U.S. citizens** (FAA Sec. 620(c): If assistance is to a government, is the government indebted to any U.S. citizen for goods or services furnished or ordered where: (a) such citizen has exhausted available legal remedies, (b) the debt is not denied or contested by such government, or (c) the indebtedness arises under an unconditional guaranty of payment given by such government or controlled entity? NO

3. **Seizure of U.S. Property** (FAA Sec. 620(e)(1)): If assistance is to a government, has it (including any government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? NO

4. **Communist countries** (FAA Secs. 620(a), 620(f), 620D; FY 1991 Appropriations Act Secs. 512, 545): Is recipient country a Communist country? If so, has the President: (a) determined that assistance to the country is vital to the security of the United States, that the recipient country is not controlled by

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the international Communist conspiracy, and that such assistance will further promote the independence of the recipient country from international communism, or (b) removed a country from applicable restrictions on assistance to communist countries upon a determination and report to Congress that such action is important to the national interest of the United States? Will assistance be provided either directly or indirectly to Angola, Cambodia, Cuba, Iraq, Libya, Vietnam, Iran or Syria? Will assistance be provided to Afghanistan without a certification, or will assistance be provided inside Afghanistan through the Soviet-controlled government of Afghanistan?	NO
5. **Mob Action** (FAA Sec. 620(j)): Has the country permitted, or failed to take adequate measures to prevent, damage or destruction by mob action of U.S. property?	NO
6. **OPIC Investment Guaranty** (FAA Sec. 620(l)): Has the country failed to enter into an investment guaranty agreement with OPIC?	NO. OPIC Agreement signed 6/12/63
7. **Seizure of U.S. Fishing Vessels** (FAA Sec. 620(o); Fishermen's Protective Act of 1967 (as amended) Sec. 5): (a) Has the country seized, or imposed any penalty or sanction against, any U.S. fishing vessel because of fishing activities in international waters? (b) If so, has any deduction required by the Fishermen's Protective Act been made?	NO
8. **Loan Default** (FAA Sec. 620(q); FY 1991 Appropriations Act Sec. 518 (Brooke Amendment)): (a) Has the government of the recipient country been in default for more than six months on interest or principal of any loan to the country under the FAA? (b) Has the country been in default for more than one year on interest or principal on any U.S. loan under a program for which the FY 1990 Appropriations Act appropriates funds?	(a) NO (b) NO

9. **Military Equipment** (FAA Sec. 620(s)): If contemplated assistance is development loan or to come from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget and amount of the country's foreign exchange or other resources spent on military equipment? (Reference may be made to the annual "Taking Into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

N/A

10. **Diplomatic Relations with U.S.** (FAA Sec. 620(t)): Has the country severed diplomatic relations with the United States? If so, have relations been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?

NO

11. **U.N. Obligations** (FAA Sec. 620(u)): What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the A.I.D. Administrator in determining the current A.I.D. Operational Year Budget? (Reference may be made to the "Taking into Consideration" memo.)

Yes. Arrearage was 245,961 A/O 5/31/91. Taken into account by the Administrator at the time of approval of the Agency OYB for FY 91.

12. **International Terrorism**

a. **Sanctuary and support** (FY 1991 Appropriations Act Sec. 556; FAA Sec. 620A): Has the country been determined by the President to: (a) grant sanctuary from prosecution to any individual or group which has committed an act of international terrorism, or (b) otherwise support international terrorism, unless the President has waived this restriction on grounds of national security or for humanitarian reasons?

NO

b. **Airport Security** (ISDCA of 1985 Sec. 552(b). Has the Secretary of State determined that the country is a high terrorist threat country after the Secretary of Transportation has determined, pursuant to section 1115(e)(2) of the Federal Aviation Act of 1958, that an airport in the country does not maintain and administer effective security measures? NO

13. **Discrimination** (FAA Sec. 666(b)): Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who is present in such country to carry out economic development programs under the FAA? NO

14. **Nuclear Technology** (FAA Secs. 669, 670): Has the country, after August 3, 1977, delivered to any other country or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards, and without special certification by the President? Has it transferred a nuclear explosive device to a non-nuclear weapon state, or if such a state, either received or detonated a nuclear explosive device? If the country is a non-nuclear weapon state, has it, on or after August 8, 1985, exported (or attempted to export) illegally from the United States any material, equipment, or technology which would contribute significantly to the ability of a country to manufacture a nuclear explosive device? (FAA Sec. 620E permits a special waiver of Sec. 669 for Pakistan.) NO

15. **Algiers Meeting** (ISDCA of 1981, Sec. 720): Was the country represented at the Meeting of Ministers of Foreign Affairs and Heads of Delegations of the Non-Aligned Countries to the 36th General Assembly of the U.N. on Sept. 25 and 28, 1981, and did it fail to disassociate itself from the communique issued? If so, has the President taken it into account? (Reference may be made to the "Taking into Consideration" memo.) Yes. Senegal "reserved orally". Such has been taken into account.

16. **Military Coup** (FY 1991 Appropriations Act Sec. 513): Has the duly elected Head of Government of the country been deposed by military coup or decree? If assistance has been terminated, has the President notified Congress that a democratically elected government has taken office prior to the resumption of assistance? NO

17. **Refugee Cooperation** (FY 1991 Appropriations Act Sec. 539): Does the recipient country fully cooperate with the international refugee assistance organizations, the United States, and other governments in facilitating lasting solutions to refugee situations, including resettlement without respect to race, sex, religion, or national origin? YES

18. **Exploitation of Children** (FY 1991 Appropriations Act Sec. 599D, amending FAA Sec. 116): Does the recipient government fail to take appropriate and adequate measures, within its means, to protect children from exploitation, abuse or forced conscription into military or paramilitary services? NO

B. COUNTRY ELIGIBILITY CRITERIA APPLICABLE ONLY TO DEVELOPMENT ASSISTANCE ("DA")

1. **Human Rights Violations** (FAA Sec. 116): Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy? NO

2. **Abortions** (FY 1991 Appropriations Act Sec. 535): Has the President certified that use of DA funds by this country would violate any of the prohibitions against use of funds to pay for the performance of abortions as a method of family planning, to motivate or coerce any person to practice abortions, to pay for the performance of involuntary NO

sterilization as a method of family planning, to coerce or provide any financial incentive to any person to undergo sterilizations, to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning?

C. COUNTRY ELIGIBILITY CRITERIA APPLICABLE ONLY TO ECONOMIC SUPPORT FUNDS ("ESF")

Human Rights Violations (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 President found that the country made such significant improvement in its human rights record that furnishing such assistance is in the U.S. national interest? NO

5C(2) - ASSISTANCE CHECKLIST

Listed below are statutory criteria applicable to the assistance resources themselves, rather than to the eligibility of a country to receive assistance. This section is divided into three parts. Part A includes criteria applicable to both Development Assistance and Economic Support Fund resources. Part B includes criteria applicable only to Development Assistance resources. Part C includes criteria applicable only to Economic Support Funds.

CROSS REFERENCE: IS COUNTRY CHECKLIST UP TO DATE?

A. CRITERIA APPLICABLE TO BOTH DEVELOPMENT ASSISTANCE AND ECONOMIC SUPPORT FUNDS

1. **Host Country Development Efforts** (FAA Sec. 601(a)): Information and conclusions on whether assistance will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.

a. N/A
b. Project will help private farmers test natural resources-based technologies to increase the productivity of cereals-based cropping systems.
c. N/A
d. Project will work with private voluntary organizations and farmers associations.
e. Project will encourage the Agriculture Research Institute (ISRA) to strengthen its capacity to plan, arrange and carry out research.
f. N/A

2. **U.S. Private Trade and Investment** (FAA Sec. 601(b)): Information and conclusions on how assistance will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

N/A

3. **Congressional Notification**

a. **General requirement** (FY 1991 Appropriations Act Secs. 523 and 591; FAA Sec. 634A): If money is to be obligated for an activity not previously justified to Congress, or for an amount in excess of amount previously justified to Congress, has Congress been properly notified (unless the notification requirement has been waived because of substantial risk to human health or welfare)?

Yes. CN forwarded to Washington June 14, 1991

b. **Notice of new account obligation** (FY 1991 Appropriations Act Sec. 514): If funds are being obligated under an appropriation account to which they were not appropriated, has the President consulted with and provided a written justification to the House and Senate Appropriations Committees and has such obligation been subject to regular notification procedures?

N/A

c. **Cash transfers and nonproject sector assistance** (FY 1991 Appropriations Act Sec. 575(b)(3)): If funds are to be made available in the form of cash transfer or nonproject sector assistance, has the Congressional notice included a detailed description of how the funds will be used, with a discussion of U.S. interests to be served and a description of any economic poolicy reforms to be promoted?

N/A

4. **Engineering and Financial Plans** (FAA Sec. 611(a)): Prior to an obligation in excess of $500,000, will there be: (a) engineering, financial or other plans necessary to carry out the assistance; and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

Yes

5. **Legislative Action** (FAA Sec. 611(a)(2)): If legislative action is required within recipient country with respect to an obligation in excess of $500,000, what is the basis for a reasonable expectation that such action

N/A

will be completed in time to permit orderly accomplishment of the purpose of the assistance?

6. **Water Resources** (FAA Sec. 611(b); FY 1991 Appropriations Act Sec. 501): If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable in accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See A.I.D. Handbook 3 for guidelines.) N/A

7. **Cash Transfer and Sector Assistance** (FY 1991 Appropriations Act Sec. 575(b)): Will cash transfer or nonproject sector assistance be maintained in a separate account and not commingled with other funds (unless such requirements are waived by Congressional notice for nonproject sector assistance)? N/A

8. **Capital Assistance** (FAA Sec. 611(e)): If project is capital assistance (e.g., construction), and total U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability to maintain and utilize the project effectively? N/A

9. **Multiple Country Objectives** (FAA Sec. 601(a)): Information and conclusions on whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

a. N/A
b. Project will help private farmers test natural resources-based technologies to increase the productivity of cereals-based cropping systems.
c. N/A
d. Project will work with private voluntary organizations and farmers associations.
e. Project will encourage the Agriculture Research Institute (ISRA) to strengthen its capacity to plan, arrange and carry out research.
f. N/A

10. **U.S. Private Trade** (FAA Sec. 601(b)): Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise). N/A

11. **Local Currencies**

a. **Recipient Contributions** (FAA Secs. 612(b), 636(h)): Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars. Waiver of host country contribution

b. **U.S.-Owned Currency** (FAA Sec. 612(d)): Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release? U.S. does not own excess foreign currency.

c. **Separate Account** (FY 1991 Appropriations Act Sec. 575). If assistance is furnished to a foreign government under arrangements which result in the generation of local currencies:

(1) Has A.I.D. (a) required that local currencies be deposited in a separate account established by the recipient government, (b) entered into an agreement with that government providing the amount of local currencies to be generated and the terms and conditions under which the currencies so deposited may be utilized, and (c) established by agreement the responsibilities of A.I.D. and that government to monitor and account for deposits into and disbursements from the separate account? N/A

(2) Will such local currencies, or an equivalent amount of local currencies, be used only to carry out the purposes of the DA or ESF chapters of the FAA (depending on which chapter is the source of the assistance) or for the administrative requirements of the United States Government? N/A

(3) Has A.I.D. taken all appropriate steps to ensure that the equivalent of local currencies disbursed from the separate account are used for the agreed purposes? N/A

(4) If assistance is terminated to a country, will any unencumbered balances of funds remaining in a separate account be disposed of for purposes agreed to by the recipient government and the United States Government? N/A

12. **Trade Restrictions**

a. **Surplus Commodities** (FY 1991 Appropriations Act Sec. 521(a)): If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity? N/A

b. **Textiles (Lautenberg Amendment)** (FY 1991 Appropriations Act Sec. 521(c)): Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U.S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of facilities specifically designed for, the manufacture for export to the United States or to third country markets in direct competition with U.S. exports, of NO

textiles, apparel, footwear, handbags, flat goods (such as wallets or coin purses worn on the person), work gloves or leather wearing apparel?

13. **Tropical Forests** (FY 1991 Appropriations Act Sec. 533(c)(3)): Will funds be used for any program, project or activity which would (a) result in any significant loss of tropical forests, or (b) involve industrial timber extraction in primary tropical forest areas?

NO

NO

14. **PVO Assistance**

a. **Auditing and registration** (FY 1991 Appropriations Act Sec. 537): If assistance is being made available to a PVO, has that organization provided upon timely request any document, file, or record necessary to the auditing requirements of A.I.D., and is the PVO registered with A.I.D.?

N/A

b. **Funding sources** (FY 1991 Appropriations Act, Title II, under heading "Private and Voluntary Organizations"): If assistance is to be made to a United States PVO (other than a cooperative development organization), does it obtain at least 20 percent of its total annual funding for international activities from sources other than the United States Government?

If funding is made available under the project to a PVO, compliance with section 537 will be assured.

15. **Project Agreement Documentation** (State Authorization Sec. 139 (as interpreted by conference report)): Has confirmation of the date of signing of the project agreement, including the amount involved, been cabled to State L/T and A.I.D. LEG within 60 days of the agreement's entry into force with respect to the United States, and has the full text of the agreement been pouched to those same offices? (See Handbook 3, Appendix 6G for agreements covered by this provision).

Project agreement will be cabled to State LT and AID Leg.

16. **Metric System** (Omnibus Trade and Competitiveness Act of 1988 Sec. 5164, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy): Does the assistance activity use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage?

Yes. As much as is feasible.

17. **Women in Development** (FY 1991 Appropriations Act, Title II, under heading "Women in Development"): Will assistance be designed so that the percentage of women participants will be demonstrably increased?

Project is designed to increase the role of women in agricultural research.

18. **Regional and Multilateral Assistance** (FAA Sec. 209): Is assistance more efficiently and effectively provided through regional or multilateral organizations? If so, why is assistance not so provided? Information and conclusions on whether assistance will encourage developing countries to cooperate in regional development programs.

NO. Assistance under the project will encourage collaboration between the Senegalese Agricultural Research Institute and regional and international agricultural research organizations.

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19. **Abortions** (FY 1991 Appropriations Act, Title II, under heading "Population, DA," and Sec. 525):	
a. Will assistance be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization?	NO
b. Will any funds be used to lobby for abortion?	NO
20. **Cooperatives** (FAA Sec. 111): Will assistance help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life?	Yes. Farmers associations and village level organizations including cooperatives will be encouraged to participate in collaborative research under the project.
21. **U.S.-Owned Foreign Currencies**	
a. **Use of currencies** (FAA Secs. 612(b), 636(h); FY 1991 Appropriations Act Secs. 507, 509): Describe steps taken to assure that, to the maximum extent possible, foreign currencies owned by the U.S. are utilized in lieu of dollars to meet the cost of contractual and other services.	N/A
b. **Release of currencies** (FAA Sec. 612(d)): Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	NO
22. **Procurement**	
a. **Small business** (FAA Sec. 602(a)): Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	YES
b. **U.S. procurement** (FAA Sec. 604(a)): Will all procurement be from the U.S. except as otherwise determined by the President or determined under delegation from him?	N/A (DFA-funded)

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c. **Marine insurance** (FAA Sec. 604(d)): If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company? Yes

d. **Non-U.S. agricultural procurement** (FAA Sec. 604(e)): If non-U.S. procurement of agricultural commodity or product thereof is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.) N/A

e. **Construction or engineering services** (FAA Sec. 604(g)): Will construction or engineering services be procured from firms of advanced developing countries which are otherwise eligible under Code 941 and which have attained a competitive capability in international markets in one of these areas? (Exception for those countries which receive direct economic assistance under the FAA and permit United States firms to compete for construction or engineering services financed from assistance programs of these countries.) N/A

f. **Cargo preference shipping** (FAA Sec. 603)): Is the shipping excluded from compliance with the requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 percent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates? N/A

g. **Technical assistance** (FAA Sec. 621(a)): If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? Will the Yes

facilities and resources of other Federal agencies be utilized, when they are particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?	NO
h. **U.S. air carriers** (International Air Transportation Fair Competitive Practices Act, 1974): If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available?	Yes
i. **Termination for convenience of U.S. Government** (FY 1991 Appropriations Act Sec. 504): If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States?	All contracts for procurement will contain a termination for convenience clause.
j. **Consulting services** (FY 1991 Appropriations Act Sec. 524): If assistance is for consulting service through procurement contract pursuant to 5 U.S.C. 3109, are contract expenditures a matter of public record and available for public inspection (unless otherwise provided by law or Executive order)?	Yes
k. **Metric conversion** (Omnibus Trade and Competitiveness Act of 1988, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy): Does the assistance program use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest	To the extent practicable.

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documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage?

1. **Competitive Selection Procedures** (FAA Sec. 601(e)): Will the assistance utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? Yes

23. **Construction**

a. **Capital project** (FAA Sec. 601(d)): If capital (e.g., construction) project, will U.S. engineering and professional services be used? N/A

b. **Construction contract** (FAA Sec. 611(c)): If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? N/A

c. **Large projects, Congressional approval** (FAA Sec. 620(k)): If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the Congressional Presentation), or does assistance have the express approval of Congress? N/A

24. **U.S. Audit Rights** (FAA Sec. 301(d)): If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? N/A

25. **Communist Assistance** (FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? Yes

26. **Narcotics**

a. **Cash reimbursements** (FAA Sec. 483): Will arrangements preclude use of financing to make reimbursements, in the form of cash payments, to persons whose illicit drug crops are eradicated? — Yes

b. **Assistance to narcotics traffickers** (FAA Sec. 487): Will arrangements take "all reasonable steps" to preclude use of financing to or through individuals or entities which we know or have reason to believe have either: (1) been convicted of a violation of any law or regulation of the United States or a foreign country relating to narcotics (or other controlled substances); or (2) been an illicit trafficker in, or otherwise involved in the illicit trafficking of, any such controlled substance? — Yes

27. **Expropriation and Land Reform** (FAA Sec. 620(g)): Will assistance preclude use of financing to compensate owners for expropriated or nationalized property, except to compensate foreign nationals in accordance with a land reform program certified by the President? — Yes

28. **Police and Prisons** (FAA Sec. 660): Will assistance preclude use of financing to provide training, advice, or any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? — Yes

29. **CIA Activities** (FAA Sec. 662): Will assistance preclude use of financing for CIA activities? — Yes

30. **Motor Vehicles** (FAA Sec. 636(i)): Will assistance preclude use of financing for purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? — N/A (DFA-funded)

31. **Military Personnel** (FY 1991 Appropriations Act Sec. 503): Will assistance preclude use of financing to pay pensions, annuities, retirement pay, or adjusted service compensation for prior or current military personnel? Yes

32. **Payment of U.N. Assessments** (FY 1991 Appropriations Act Sec. 505): Will assistance preclude use of financing to pay U.N. assessments, arrearages or dues? Yes

33. **Multilateral Organization Lending** (FY 1991 Appropriations Act Sec. 506): Will assistance preclude use of financing to carry out provisions of FAA section 209(d) (transfer of FAA funds to multilateral organizations for lending)? Yes

34. **Export of Nuclear Resources** (FY 1991 Appropriations Act Sec. 510): Will assistance preclude use of financing to finance the export of nuclear equipment, fuel, or technology? Yes

35. **Repression of Population** (FY 1991 Appropriations Act Sec. 511): Will assistance preclude use of financing for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? Yes

36. **Publicity or Propoganda** (FY 1991 Appropriations Act Sec. 516): Will assistance be used for publicity or propaganda purposes designed to support or defeat legislation pending before Congress, to influence in any way the outcome of a political election in the United States, or for any publicity or propaganda purposes not authorized by Congress? Yes

37. **Marine Insurance** (FY 1991 Appropriations Act Sec. 563): Will any A.I.D. contract and solicitation, and subcontract entered into under such contract, include a clause requiring that U.S. marine insurance companies have a fair opportunity to bid for marine insurance when such insurance is necessary or appropriate? — Yes

38. **Exchange for Prohibited Act** (FY 1991 Appropriations Act Sec. 569): Will any assistance be provided to any foreign government (including any instrumentality or agency thereof), foreign person, or United States person in exchange for that foreign government or person undertaking any action which is, if carried out by the United States Government, a United States official or employee, expressly prohibited by a provision of United States law? — Yes

B. CRITERIA APPLICABLE TO DEVELOPMENT ASSISTANCE ONLY

1. **Agricultural Exports (Bumpers Amendment)** (FY 1991 Appropriations Act Sec. 521(b), as interpreted by conference report for original enactment): If assistance is for agricultural development activities (specifically, any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference, or training), are such activities: (1) specifically and principally designed to increase agricultural exports by the host country to a country other than the United States, where the export would lead to direct competition in that third country with exports of a similar commodity grown or produced in the United States, and can the activities reasonably be expected to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (2) in support of research that is intended primarily to benefit U.S. producers? — (1) No. (2) No.

2. **Tied Aid Credits** (FY 1991 Appropriations Act, Title II, under heading "Economic Support Fund"): Will DA funds be used for tied aid credits?	NO
3. **Appropriate Technology** (FAA Sec. 107): Is special emphasis placed on use of appropriate technology (defined as relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	Yes. The project is designed to generate low-cost, appropriate natural resources-based agricultural technologies.
4. **Indigenous Needs and Resources** (FAA Sec. 281(b)): Describe extent to which the activity recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.	Activity encourages local farmer participation in the process of identifying research needs and designing and executing research activities.
5. **Economic Development** (FAA Sec. 101(a)): Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Major focus of the Project is to help farmers develop sustainable cropping systems.
6. **Special Development Emphases** (FAA Secs. 102(b), 113, 281(a)): Describe extent to which activity will: (a) effectively involve the poor in development by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, dispersing investment from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using appropriate U.S. institutions; (b) encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries	(a) Project will involve farmers in identifying research priorities, design and execution of research activities, focusing on appropriate low-cost, natural resources-based agricultural technologies. (b) N/A (c) Project will work with PVOs and farmers associations to develop and carry out research activities and to involve farmers themselves in research planning and testing. (d) Project will promote women in the research process both as researchers and users of the technologies. (e) Project provides funds to encourage regional contact and collaboration in agricultural research.

and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries.

7. **Recipient Country Contribution** (FAA Secs. 110, 124(d)): Will the recipient country provide at least 25 percent of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?

NO. Waiver of host country contribution has been requested.

8. **Benefit to Poor Majority** (FAA Sec. 128(b)): If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?

Project will increase institutional capacities of local NGOs and farmers associations whose main beneficiaries are the very poorest rural villagers.

9. **Abortions** (FAA Sec. 104(f); FY 1991 Appropriations Act, Title II, under heading "Population, DA," and Sec. 535):

a. Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions?

NO

b. Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilizations?

NO

c. Are any of the funds to be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization?

NO

d. Will funds be made available only to voluntary family planning projects which offer, either directly or through referral to, or information about access to, a broad range of family planning methods and services? — Yes

e. In awarding grants for natural family planning, will any applicant be discriminated against because of such applicant's religious or conscientious commitment to offer only natural family planning? — NO

f. Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning? — NO

g. Are any of the funds to be made available to any organization if the President certifies that the use of these funds by such organization would violate any of the above provisions related to abortions and involuntary sterilization? — NO

10. **Contract Awards** (FAA Sec. 601(e)): Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? — The project will use Title XII procedures in contracting for the technical assistance contract. Any services outside the TA contract will be competitively procured.

11. **Disadvantaged Enterprises** (FY 1991 Appropriations Act Sec. 567): What portion of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, colleges and universities having a student body in which more than 40 percent of the students are Hispanic Americans, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)? — Section 567 will be fully complied with.

12. **Biological Diversity** (FAA Sec. 119(g): Will the assistance: (a) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity; (b) be provided under a long-term agreement in which the recipient country agrees to protect ecosystems or other wildlife habitats; (c) support efforts to identify and survey ecosystems in recipient countries worthy of protection; or (d) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas?

a. Project will provide support for the development of natural-resources-based technologies, including training.

b. NO

c. Some research will relate to protection of natural forests and their regeneration.

d. NO.

13. **Tropical Forests** (FAA Sec. 118; FY 1991 Appropriations Act Sec. 533(c)-(e) & (g)):

a. **A.I.D. Regulation 16:** Does the assistance comply with the environmental procedures set forth in A.I.D. Regulation 16?

b. **Conservation:** Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (1) stress the importance of conserving and sustainably managing forest resources; (2) support activities which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and help countries identify and implement alternatives to colonizing forested areas; (3) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (4) help end destructive slash-and-burn agriculture by supporting stable and productive farming practices; (5) help conserve forests which have not yet been degraded by helping to increase production on lands already cleared or degraded; (6) conserve forested watersheds and rehabilitate those which have been deforested; (7) support training, research, and other actions

13. Yes. The project is to design, to develop, test and encourage adoption of sound, sustainable natural resources based agricultural technologies.

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which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (8) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (9) conserve biological diversity in forest areas by supporting efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis, by making the establishment of protected areas a condition of support for activities involving forest clearance or degradation, and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas; (10) seek to increase the awareness of U.S. Government agencies and other donors of the immediate and long-term value of tropical forests; (11) utilize the resources and abilities of all relevant U.S. government agencies; (12) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land; and (13) take full account of the environmental impacts of the proposed activities on biological diversity?

c. **Forest degradation:** Will assistance be used for: (1) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner and that the proposed activity will produce positive economic benefits and sustainable forest management systems; (2) actions which will significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas; (3) activities which would result in the conversion of forest lands to the rearing of livestock; (4) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undergraded

1. NO
2. NO
3. NO
4. NO

forest lands; (5) the colonization of forest lands; or (6) the construction of dams or other water control structures which flood relatively undergraded forest lands, unless with respect to each such activity an environmental assessment indicates that the activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development?

5. NO

6. NO

d. **Sustainable forestry:** If assistance relates to tropical forests, will project assist countries in developing a systematic analysis of the appropriate use of their total tropical forest resources, with the goal of developing a national program for sustainable forestry?

Project will include research on sustainable forestry and will fund studies relating to appropriate use of forest resources.

e. **Environmental impact statements:** Will funds be made available in accordance with provisions of FAA Section 117(c) and applicable A.I.D. regulations requiring an environmental impact statement for activities significantly affecting the environment?

N/A

The bureau environmental officer has determined that no environmental impact statement is required.

14. **Energy** (FY 1991 Appropriations Act Sec. 533(c)): If assistance relates to energy, will such assistance focus on: (a) end-use energy efficiency, least-cost energy planning, and renewable energy resources, and (b) the key countries where assistance would have the greatest impact on reducing emissions from greenhouse gases?

N/A

15. **Sub-Saharan Africa Assistance** (FY 1991 Appropriations Act Sec. 562, adding a new FAA chapter 10 (FAA Sec. 496)): If assistance will come from the Sub-Saharan Africa DA account, is it: (a) to be used to help the poor majority in Sub-Saharan Africa through a process of long-term development and economic growth that is equitable, participatory, environmentally sustainable, and self-reliant; (b) to be used to promote sustained economic growth, encourage

a. Yes. Project encourages small farmers participation in research design implementation and evaluation.

b. Yes. Project will work to involve NGOs and private organizations to the extent feasible.

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private sector development, promote individual initiatives, and help to reduce the role of central governments in areas more appropriate for the private sector; (c) to be provided in a manner that takes into account, during the planning process, the local-level perspectives of the rural and urban poor, including women, through close consultation with African, United States and other PVOs that have demonstrated effectiveness in the promotion of local grassroots activities on behalf of long-term development in Sub-Saharan Africa; (d) to be implemented in a manner that requires local people, including women, to be closely consulted and involved, if the assistance has a local focus; (e) being used primarily to promote reform of critical sectoral economic policies, or to support the critical sector priorities of agricultural production and natural resources, health, voluntary family planning services, education, and income generating opportunities; and (f) to be provided in a manner that, if policy reforms are to be effected, contains provisions to protect vulnerable groups and the environment from possible negative consequences of the reforms?

c. Yes. The project encourages farmer participation in the research process through NGOs.

d. Yes. The project specifically targets women for training.

e. Yes. Improved agricultural productivity and better use of natural resources are key objectives for the project.

f. N/A.

16. **Debt-for-Nature Exchange (FAA Sec. 463):** If project will finance a debt-for-nature exchange, describe how the exchange will support protection of: (a) the world's oceans and atmosphere, (b) animal and plant species, and (c) parks and reserves; or describe how the exchange will promote: (d) natural resource management, (e) local conservation programs, (f) conservation training programs, (g) public commitment to conservation, (h) land and ecosystem management, and (i) regenerative approaches in farming, forestry, fishing, and watershed management.

N/A

17. **Deobligation/Reobligation** (FY 1991 Appropriations Act Sec. 515): If deob/reob authority is sought to be exercised in the provision of DA assistance, are the funds being obligated for the same general purpose, and for countries within the same region as originally obligated, and have the House and Senate Appropriations Committees been properly notified? N/A

18. **Loans**

a. **Repayment capacity** (FAA Sec. 122(b)): Information and conclusion on capacity of the country to repay the loan at a reasonable rate of interest. N/A

b. **Long-range plans** (FAA Sec. 122(b)): Does the activity give reasonable promise of assisting long-range plans and programs designed to develop economic resources and increase productive capacities? Yes

c. **Interest rate** (FAA Sec. 122(b)): If development loan is repayable in dollars, is interest rate at least 2 percent per annum during a grace period which is not to exceed ten years, and at least 3 percent per annum thereafter? N/A

d. **Exports to United States** (FAA Sec. 620(d)): If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20 percent of the enterprise's annual production during the life of the loan, or has the requirement to enter into such an agreement been waived by the President because of a national security interest? N/A

19. **Development Objectives** (FAA Secs. 102(a), 111, 113, 281(a)): Extent to which activity will: (1) effectively involve the poor in development, by expanding access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from

(1) Project will involve small farmers in identifying research priorities, design and execution of research activities; focusing on appropriate low-cost, natural resources-based agricultural technologies.

cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (2) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (3) support the self-help efforts of developing countries; (4) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (5) utilize and encourage regional cooperation by developing countries?

(2) N/A
(3) Project will work with PVOs and farmers associations to develop and carry out research activities and to involve farmers themselves in research planning and testing.
(4) Project will promote women the research process both as researchers and users of the technologies.
(5) Project provides funds to encourage regional contact and collaboration in agricultural research.

20. **Agriculture, Rural Development and Nutrition, and Agricultural Research** (FAA Secs. 103 and 103A):

a. **Rural poor and small farmers:** If assistance is being made available for agriculture, rural development or nutrition, describe extent to which activity is specifically designed to increase productivity and income of rural poor; or if assistance is being made available for agricultural research, has account been taken of the needs of small farmers, and extensive use of field testing to adapt basic research to local conditions shall be made.

Project seeks to increase farme income through increasing productivity of cropping systems The project provides for small farmer needs assessments as pa of the research design and encourages farmer participation in on-farm research.

b. **Nutrition:** Describe extent to which assistance is used in coordination with efforts carried out under FAA Section 104 (Population and Health) to help improve nutrition of the people of developing countries through encouragement of increased production of crops with greater nutritional value; improvement of planning, research, and education with respect to nutrition, particularly with reference to improvement and expanded use of indigenously produced foodstuffs; and the undertaking of pilot or demonstration programs explicitly addressing the problem of malnutrition of poor and vulnerable people.

N/A

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c. **Food security:** Describe extent to which activity increases national food security by improving food policies and management and by strengthening national food reserves, with particular concern for the needs of the poor, through measures encouraging domestic production, building national food reserves, expanding available storage facilities, reducing post harvest food losses, and improving food distribution.

Project aims at increasing cropping systems productivity through improved management of natural resources.

21. **Population and Health** (FAA Secs. 104(b) and (c)): If assistance is being made available for population or health activities, describe extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems, and other modes of community outreach.

N/A

22. **Education and Human Resources Development** (FAA Sec. 105): If assistance is being made available for education, public administration, or human resource development, describe (a) extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, and strengthens management capability of institutions enabling the poor to participate in development; and (b) extent to which assistance provides advanced education and training of people of developing countries in such disciplines as are required for planning and implementation of public and private development activities.

N/A

23. **Energy, Private Voluntary Organizations, and Selected Development Activities** (FAA Sec. 106): If assistance is being made available for energy, private voluntary organizations, and selected development problems, describe extent to which activity is:

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a. concerned with data collection and analysis, the training of skilled personnel, research on and development of suitable energy sources, and pilot projects to test new methods of energy production; and facilitative of research on and development and use of small-scale, decentralized, renewable energy sources for rural areas, emphasizing development of energy resources which are environmentally acceptable and require minimum capital investment;	N/A
b. concerned with technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;	Encourages collaboration between ISRA and NGOs, local as well as U.S.
c. research into, and evaluation of, economic development processes and techniques;	Collaborative research with NGOs on natural resources-based agriculture.
d. reconstruction after natural or manmade disaster and programs of disaster preparedness;	
e. for special development problems, and to enable proper utilization of infrastructure and related projects funded with earlier U.S. assistance;	N/A
f. for urban development, especially small, labor-intensive enterprises, marketing systems for small producers, and financial or other institutions to help urban poor participate in economic and social development.	N/A

C. CRITERIA APPLICABLE TO ECONOMIC SUPPORT FUNDS ONLY N/A

1. **Economic and Political Stability** (FAA Sec. 531(a)): Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of Part I of the FAA?

2. **Military Purposes** (FAA Sec. 531(e)): Will this assistance be used for military or paramilitary purposes?

3. **Commodity Grants/Separate Accounts** (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? (For FY 1991, this provision is superseded by the separate account requirements of FY 1991 Appropriations Act Sec. 575(a), see Sec. 575(a)(5).)

4. **Generation and Use of Local Currencies** (FAA Sec. 531(d)): Will ESF funds made available for commodity import programs or other program assistance be used to generate local currencies? If so, will at least 50 percent of such local currencies be available to support activities consistent with the objectives of FAA sections 103 through 106? (For FY 1991, this provision is superseded by the separate account requirements of FY 1991 Appropriations Act Sec. 575(a), see Sec. 575(a)(5).)

5. **Cash Transfer Requirements** (FY 1991 Appropriations Act, Title II, under heading "Economic Support Fund," and Sec. 575(b)). If assistance is in the form of a cash transfer:

a. **Separate account:** Are all such cash payments to be maintained by the country in a separate account and not to be commingled with any other funds?

b. **Local currencies:** Will all local currencies that may be generated with funds provided as a cash transfer to such a country also be deposited in a special account, and has A.I.D. entered into an agreement with that government setting forth the amount of the local currencies to be generated, the terms and conditions under which they are to be used, and the responsibilities of A.I.D. and that government to monitor and account for deposits and disbursements?

c. **U.S. Government use of local currencies:** Will all such local currencies also be used in accordance with FAA Section 609, which requires such local currencies to be made available to the U.S. government as the U.S. determines necessary for the requirements of the U.S. Government, and which requires the remainder to be used for programs agreed to by the U.S. Government to carry out the purposes for which new funds authorized by the FAA would themselves be available?

d. **Congressional notice:** Has Congress received prior notification providing in detail how the funds will be used, including the U.S. interests that will be served by the assistance, and, as appropriate, the economic policy reforms that will be promoted by the cash transfer assistance?

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TECHNICAL ANALYSIS

Development of the Technical Analysis: The NRBAR project paper was a collaborative design effort between ISRA, USAID, AID/W, and three USAID-contracted technical assistants. A meeting was held at the U.S. Cultural Center in Dakar on April 5th in which the outline of the technical analysis was developed and four ISRA-led teams were formed to analyse the following subject areas for inclusion as the technical analysis: soil and water; general agronomy including integration of livestock; agro-forestry; and socio-economics. USAID staff were appointed to the technical sub-committees as well. At the same meeting, USAID-led teams were organized to complete the financial, socio-economic, institutional, and economic analyses.

Each sub-committee meet several times to prepare a draft technical analysis which was presented, reviewed, and refined at a two day, joint design seminar held at the ISRA station at bambey, May 21-22, 1991. During that meeting, general themes were developed and incorporated into the technical analysis. It was agreed during that meeting that the entire report of the technical sub-committees would be included in the project paper as an annex.

The following section organizes the work of the various technical teams and includes summaries of the work of the ISRA team in English and the USAID-financed technical assistant.

A. Supplemental Technical Analysis

Overview:

Resources of the Project Zone

1) Land Resources

Senegal's total land area is 19,6 million hectares of which 3,8 million hectares (19% of total land area) is arable and 2,4 million hectares are cultivated annually. About 2.2 million hectares is in rainfed crops each year. In 1970-1980 there was a decline in cropped area due to poor rains, over-cultivation and migration.

Food crops

millet is the most important crop in terms of area planted in the project zone, followed by groundnuts for oil. Other food crops are maize 4.5% of area planted, cowpeas (4,1%), paddy (3,5%). While maize and cowpeas cultivation increased in recent years. Maize is replacing millet in the higher rainfall zones and cowpeas are replacing peanuts in the lower rainfall zones. In the Casamance rice is an important crop and cotton in Senegal Oriental.

Cash crops

In 1980-1991, about 77% of all peanuts were produced in the Peanut Basin. Also 84% of all millet/sorghum was produced in this zone, where half of the country's population lives. Senegal's livestock level in 1983 was estimated to be 2.2 million cattle, there were 3.4 million sheep and goats. Senegal consumes 960,000 tons of firewood and 220,000 tons of charcoal. Fuelwood contributes 63% of Senegal's total energy requirements.

2) Water resources

The Peanut Basin contains an aquifer with good potential for groundwater development at a depth of more than 60 M throughout the entire zone. There is an over-exploitation of the Peanut Basin aquifer, in relation to its yields; to meet the Dakar water supply demand. Most studies were performed for water supply and additional studies are needed to determine the potential and suitability for irrigated agriculture. Two aquifers are identified in the Casamance. They are shallow and are the most important if not the only water source for most villages. Some areas in the lower Casamance show a great water potential for irrigated agriculture, however the concern is the high iron content.

In Senegal Oriental there is insufficient information about aquifers and little date is available.

In the Peanut Basin watersheds with runoff potential ranging from 10-14 million m^3 were identified. In the Upper-Casamance six watersheds with runoff potential estimated at 53 million m^3 and in Senegal Oriental four watersheds with a total annual runoff of 30 million m^3 were identified.

Water conservation

Diola rice farmers (Casamance) have controlled rain water runoff and river water to practice irrigated rice cultivation. The following are some examples of techniques which are used in Senegal:

(A) Salt-Barrier and water retention Dam in lower-Casamance with participation of Commité d'Action pour le Développement du Forgny (CADEF). A Reservoir controls upstream water level and flushes fields downstream after flood recedes. Livestock uses water from the reservoir.

(B) Southern Zone Water Management Project (SZWM) (USAID) assists farmers to build small contour dikes across their fields to hold rainwater.

Some of the general soil resource management problems are degradation, wind erosion, acidification, extensive farming and lack of economic motivation for good management.

Continuous Cropping:

Evidence of continuous cropping while soil fertility was maintained are the following examples':

(1) Land close to the village (Toll Keur) is used for short season crops it is continuously cropped and by means of household refuse and animal manures soil fertility was maintained. Animals grazed the fallow areas during the day or were kept in the village at night. Sanford (1989) calls this process "internal transport of plant nutrients" by livestock. Thus plant nutrients from the fallow land are transported to the Toll Keur in the village. Wooded fallow protected and regenerated outlying fields, it is also a major source of nutrients for the Toll Keur crops.

Fallowing is not any longer practiced in the Peanut Basin because of land pressure, dense population and continuous cultivation and thus fertility of the fields is low.

(2) A study of three Serer villages by (1990) in the Peanut Basin found that after 30 years, there had not been any decline in yields. In 1980 farmers used shorter season varieties of seed to compensate for drier weather and the use of animal traction in planting and cultivating. Farms maintained their yields on a per unit basis.

(3) Rodale (1989) found that there was no significant long term decline in yields per unit area for millet, sorghum or peanuts in three locations in the Peanut Basin over a period of 28 years.

With the collapse of "the wooded fallow", soil management system, the soil degraded quickly to establish a new equilibrium. The economic link between the wooded fallow system for soil maintenance and fertility and protection of the soil from wind erosion and the link between crop yields and soil conservation is the fundamental soil resource management problem in the Peanut Basin. Soils of the Peanut Basin lost the nutrients which were contributed by organic matter, because of burning. Soil resource management in the Peanut Basin lacks the economic link between protecting or conserving soils and improving yields on these soils. Improved organic matter, also retains moisture in the soil.

Freeman (1983) indicated 290,000 hectares (25% of the arable ground) is not utilised in Sine Saloum, because soils are higher in clay content and have more structural and water infiltration problems, as a result of the collapse of the wooded fallow. In Louga 110,000 hectares (22% tillable land) is not used. There is an urgent need to develop technologies that make the most efficient use of the limited climatic and soil resources. Researchers should pay attention to characteristics of the climatic and soil resources. The solution to continuous cropping in the Peanut Basin is the extension of Toll Keur soil management practices to outlying fields. The Toll Keur were fertilised by organic manures and were not burned. Traditional farmers are now using animal manures on outlying fields and household refuse on the Toll Keur. In an attempt to deal annually with soil fertility problems, Rodale and Freeman indicated that there are insufficient animals to provide the needed manure for the Peanut Basin.

Rodale is experimenting with composting and use of chemical fertilisers as an alternative solution to increased plant nutrition. The source of plant nutrients and the quality of manure depend on the quality of animal feed. Thus the animals of the Peanut Basin which are eating poor quality feed are producing poor quality manure.

Seyler observed that farmers protect Acacia Albida seedlings after fertiliser subsidies were discontinued. Thus an economic link was established between crop yields and trees, which can have a positive effect on soil conservation and Agroforestry. Alley cropping is an other form of agroforestry.

Other researchers suggest that leaving crop residues on the ground would reduce soil erosion and increase water infiltration. However a strong economic incentive exist to use crop residues for forage.

Soil resource management problems in the Peanut Basin are difficult to address because they are a part of a complex balance which is difficult to change.

Based on the technical problems in the Peanut Basin, Senegal Oriental and the Casamance, the focus of the analysis is placed on three priority research areas which are common to the project zone: (A) Soil fertility; (B) Water management; and (C) General agronomy and livestock in farming systems. The project zone is divided into 4 smaller zones: (1) North-Central Peanut Basin and (2) South-Central Peanut Basin, (3) Senegal Oriental and Haute Casamance and (4) Southwest Casamance.
The technical analysis is organized along the lines of the 4 zones mentioned above with a brief discussion of the problems; the three research priority areas and the ISRA proposed project activities for each zone.

B. Technical Problems

The problems in the project zones are the following: (A) The Peanut Basin (includes North and South Central Peanut Basin) with reduced rainfall, degradation of the natural vegetation and soils vulnerable to wind and breakdown of soil structure, population pressure, over-exploitation of natural resources, reduced fallowing, infertile soils, reduced forest and woody plants and an inbalance between trees-crops and livestock systems; (B) Senegal Oriental and Haute Casamance with reduced rainfall, soil degradation less fallow, reduced forest and overuse of trees; poor shallow upland soils, southeastern soils are vulnerable to water erosion when bare; and (C) Lower Casamance is divided into valley and plateau areas. In the valley areas serious soil-salinisation and acidity problems exist and as a result rice growing areas are reduced. Degradation of natural resources occurs when farmers move and clear land in the higher plateau areas. Here deforestation takes place which in turn causes erosion and loss of fragile soils.

Peanut Basin

The Peanut Basin is Senegal's most intensely cultivated and densely populated rural region. It is divided into two zones: North and South-Central Peanut Basin. It includes the areas of: Thies, Diourbel, Louga, Fatick and Kaolack. The Peanut Basin zone covers 1/3 of Senegal's total land area with 1/2 of the country's total population or 60% of the total rural population.

(A) North-Central Groundnut Basin

This zone covers the administrative regions of Thies, Diourbel and Louga. The population of this area is 1,857,000 which accounts for approximately 30% of the nations's population. The population densities vary from (Louga) 36 to (Diourbel) 110 and (Thies) 145 inhabitants/km^2. These are the densest populated areas in this zone.

The two major crops that are planted in this zone are: peanuts: 27% of total arable land in the region and millet 35% (average 1980-1990). Other crops are sorghum, cowpea, maize, paddy, cassava and cotton.

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- The basic problems of this zone are:

  - dense population
  - soils are degraded and vulnerable to wind
  - erosion
  - soil fertility has declined
  - water management is lacking
  - reduced fallows and over-exploitation of soils
  - low yields
  - inbalance of agro-sylvo-pastoral system

Population:

The population of this zone is estimated at 1.4 million mostly Wolof and Serer.

There are no permanent water sources, the area depends on underground water resources and a system of wells. Underground water resources depend on the rainfall. The principal crop is peanuts, 53% of the total area cultivated in Senegal. It contributes to 3/4 of the total income of the rural population in this zone.

Farming enterprises:

The zone of Louga, Diourbel and Thiès produces 30% peanuts and 33% millet and sorghum of the total Senegal production.
The average farm size is 0,7 hectares : In this zone one finds three distinct farming systems. The first is the system of the marabouts (religious leaders), they play an important role in developing the peanut crop and influence cooperatives and access to credit. They produce 5-6% of Senegal's peanut production. The second system is one of large farms which produce both cereals and peanuts these farmers have access to the extension service.
The third system is one of small far ers who grow cereals, peanuts and other cash crops and they have no contact with extension.

The second crop in the project zone is millet/sorghum it occupies x 33% of the total area cultivated in Senegal.
Cereals are grown for family consumption. Other crops are maize which gives higher yields than sorghum/millet and a potential future expansion of maize is possible. Cowpea is more drought tolerant and is replacing peanuts.

Vegetables are cultivated on approximately 2000 hectares in this zone, expansion is reduced by water limitations. Cassava is an other cash crop around Thiès, Louga and Kaolack.
Other cash income comes from tree and forest resources such as fruits.

The agricultural season starts with cleaning (in April) of the fields, planting (mid June-July), maintenance and harvest. Planting is done with the hoe (daba) or by means of animal traction with a planter. Maintenance includes weeding, crop protection and maintaining the humidity in the soil. Weeding takes place twice,

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just after the plants emerge and again one month after this. For all crops in this area except the Cassava the harvest begins in October till mid-November.

Livestock

Eighteen percent of the national herd is located in the North Central Peanut Basin. The Wolof farmers keep their small livestock in enclosed areas but the large animals are kept by the Peuls.

The Serer have a real integration between agriculture and livestock. During the rainy season the herds are placed in the fallow areas. After the harvest the animals are placed in the fields where crop residue adds to their diet.
The animals used for traction or for fattenings stay all year long in an enclosure, where they are fed leftovers of agricultural or forestry products.

Trees and shrubs

Acacia albida is the most important tree in the traditional farming system both by the Wolof and Serer. This tree plays an important role in the agricultural and livestock system. At the beginning of the rainy season (June) this tree looses its leaves, which serve as organic matter for the different crops millet and sorghum. As soon as the rains stop, the Acacia trees start to bear leaves, which serve as food and shade for livestock. In return the animals contribute organic matter to the soil.

ISRA Proposed research objectives for this zone are the following:

1. A regional inventory of natural resources - Assessment of degradation level;

2. A study on the evolution of soils;

3. A study on wind erosion : quantification and control methods;

4. An analysis of the land use system in relation with the soil and water management;

5. An assessment of the impact of land management at various scales;

6. A regeneration study of degraded soils based on valorization of available natural resources (crop residues, trees, natural phosphates, empty shell-fish);

7. A regional study on organic and mineral fertilization of crops;

8. An improvement study of production and management of animal wastes use;

9. An improvement study of use and management of draught animals;

10. Assistance to farmers' organization for the adoption and assessment of appropriate technology and implementation of natural resources management rules.

B) South-Central Peanut Basin (Sine-Saloum/Kaolack and Fatick)

The South-Central Peanut Basin is divided into two administrative regions: Kaolack and Fatick. It covers 24,000 km^2 with a population of approximately 1,300,000 inhabitants. It is a main agricultural area of Senegal with two major crops, millet and peanuts which account for groundnut: 33% and millet/sorghum: 37% of arable land in the Region (Average 1980-1991) and represent nearly 50% of the national production. The major crops are: millet, sorghum, peanuts, maïze, cotton and cowpea. The crop yields are closely related to the rainfall and fertilizer use is very low.

Problem areas of this zone are similar to those mentioned for the North-Central Peanut Basin

Zone South-Central Peanut Basin (Sine-Saloum) (Kaolack, Fatick)

There are approximately 1.3 million inhabitants in this zone, which covers 23,945 km2 and represents 12% of the total land area of Senegal. There are two sub-zones. The first covers the Fatick region and the department of Kaolack.

The second sub-zone is located in Nioro du Rip and Kaffrine, which produced 25 to 30% to the peanut and cereal production of the Peanut Basin. Farmers also produce cotton.

The South Central Peanut Basin with the river Saloum which offers salt water. Underground water sources are the Continental Terminal (40-120 M) and the second source which is deeper. (200 - 400 M), this makes exploitation difficult.

For the last 5 years the average rainfall was around 600 MM with variations depending on location. Kaolack with 500 - 600 MM, Fatick with 700 - 800 MM. This zone is influenced by the seawinds and climate. The vegetation becomes more dense in the South and East. Dominant are the Combrelacees (Acacia seyal and A. ataxacantha). The vegetation in the South is dominated by Anogeissus Leiocarpus and other varieties while the underbrush is Cassia Sieberiana.

In the Kaolack/Fatick area one finds forests of predominantly Borassus aethiopuim (Roniers), oilpalms and mangroves on the side of the sea, and the Baobab.

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There are 4 major soil types in this zone.

The population is composed of 4 ethnic groups: the wolofs (Center and West), the Serer (NW and SW), the Peuls (Mixed with Wolof and Serers), Mandingues (SW with Serer)),

The Wolof-villages are between 150-200 inhabitants and they form independent unities, which grow closer to the South, where the population density is less than 100 per persons per km2. The millet fields surround the village. The fields are divided into peanut and millet parcels and a little fallow.

In the Serer villages one sees the tree rimmed fields. The Acacia albida trees increase with the same intensity as the forest decreases. The fallow areas have decreased with the onset of population growth and expansion of peanut production. The animals are always there in the dry season but transhume to the salinised soils of the Sine Saloum in the rainy season. Fields of peanut and millet occupy all the space and are intensely cultivated. The living areas are composed of the houses of the families and the space behind the houses is used for warehousing, small ruminants and traction animals, vegetables and short varities of cereals. The cultivated areas are subdivided and individualised and separated, from the village grounds. Each sub-division is shaped in concentric circles and each section of the circle, corresponds to a major crop rotation. The 1st section behind the gardens of the house is called house-field, where one plants short cycle cereals (SUNA). These are the fields which are fertilised by the animals. The second section; more extensive in size is cultivated in rotation of fallow-peanuts - cereal-peanuts.

The third section, which does not anymore exist in many villages are the most recent cleared fields. These fields are cultivated in cereals (long cycle) the first year and millet or sorghum followed by peanuts and fallow.

Land tenure;

The traditional law is maintained as well as government laws, these garantee the continuity in the Basin.

One can distinguish 3 stages of agricultural development in this zone:

(1) Agriculture is dominated by food crops (cereals and tubers). This agriculture is characterised by: manual labor, fallow to regenerate the soils, favorable rainfall and environment and available land and meadows.

(2) The system has evolved into one which is dominated by peanuts in relation to other crops. Agriculture is characterised by mechanisation (by means of credit from cooperatives) fertilizers, and a decrease in long cycle cereals and sorghum.

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(3) Since 1980 a newtype of agriculture emerged characterised by climatic reductions in rainfall, less fertile soils, predominant crops are peanuts and millet (SOUNA).

Thus the main crops are millet as a foodcrop and peanut as cash crop. The rotation peanut-millet is yearly with rarely a fallow in the third year. The fallow time is reduced because of population pressure. Other crops such as maize, cotton, cowpea, sorghum are also cultivated. Average production data by MDR in 1987/88 are:

1000-1200 Kg/Hect. for peanuts Fatick/Kaolack
800 Kg/Hect. for millet
750 - 1450/Hect. for maize
750/Hect. Fatick and 1200 Kg/Hect. Kaolack for sorghum.

The peanut fields are the best maintained (fertiliser, manure, better weeding, intensive care). The soil preparation and planting are the same for millet and peanut but the timing of these activities differs.

Millet is always planted just before sustained rains start. Weeding takes place in April/May followed by bunding and burning of debris, followed by placing of fertilisers/manure for peanuts. Clearing of fields takes place in May/June followed by burning and fertilisers/manure are placed afterwards.

Livestock

There are two traditional livestock systems. The pastoral based transhumance system with Peul herders and the sedentary system by farmers.

The pastoral transhumance system can only be found east of this zone in the area of Kaolack/Tambacounda/Kayes. This system includes migration, which is seasonal, and goes in phases. In the rainy season the herders and herds move to the Ferlo and in the dry season they move towards the Senegal Valley or to the west and the south or the Peanut Basin where they find fallow areas, wells and markets (rural and urban) for the sale of milk products and animals.

The sedentary system is included in the farmer's workload. The best livestock farmers are the Serer, who keep large herds and use the manure to systematically fertilize their fields. Here the animals browse freely during the dry season and near the village. They are moved during the rainy season by herders to the forest or the fields in temporary fallow areas. But every night the herd comes back to the village within the fenced areas.

Animal traction is a recent activity of sedentary livestock farming. The farmers feed the traction animals in the stable and draw substantial benefits from resale of these animals. Some farmers are beginning to fatten their animals which they buy from Peul herder's at the beginning of the dry season and which they sell 6 months later as slaughter animals. The same thing is done with lambs before the feast of Tabaski.

The caring for lambs and goats is reserved for women in most villages. In the dry season, the animals feed on crop residue and forrages which they find. At night they return to the village and go back to pasture. Complementary feeding with peanut or cowpea hay is given to certain lambs. In the rainy season the grazing areas are organized for 2 groups, the individual or collective herds. For individual herding each woman brings her herd in the morning to a grassy spot and ties them up. In the middle of the day she moves them and at night they return to the farm to feed and drink. The second method is to hire a herder at the beginning of July to herd all the ruminants of the village for 6 months (July - December).

Trees and Forests

There are 38 forests covering 722.417 hectares or 30,17% of the total area of the region Kaolack and Fatick. The tree species are varied and forests are producing little because of the population pressure and overuse. A reforestation efforts is supported by DCSR-ISRA-SODEVA.

ISRA's proposed research activities:

The following are research activities proposed by ISRA researchers:

- Regeneration of degraded soils with crop residues and manure;
- Soil improvement by means of crop residues and manure;
- Study of organic and mineral fertilization of crops
- Regional inventory of natural resources - Assessment of degradation level;
- Improved production and management of animal waste
- Study on the evolution of soils;
- Improved use and management of draught animals
- Recovery of salt land;
- Study on wind erosion: quantification and control method;
- Analysis of the land use systems in relation with soil and water management;
- Assist farmers' organizations for adoption and assessments of appropriate technology and implementation of natural resources.
- Socio-economic analysis of land management and natural resources management techniques;

- Evaluation of the impact of land management at various scales;

- Improvement and management of fallows;

- Management of pastoral environment and improvement of forrage balance.

(C) Senegal Oriental and Haute Casamance (Kolda)

The population of Senegal Oriental and Haute Casamance is composed of Peulhs (46%), Mandingues (13%), Toucouleurs (10%) and Soninkés (8%). The total population is estimated at 553.000 habitants. Their principal activity is agriculture. There is a demographic flux (Rural exodus, emigration and seasonal movements) which explains the low density 89 habitants/km^2 of the population. The National Park of Niokolokoba and classified forests are located in this zone.

The rainfall is between 600 mm (Sine-Saloum) to 1200 mm (Kedougou). Only 3% of the total land area is used for agricultural purposes. The principal crop is peanuts (53% of the cultivated area) and also cereals (including maize, sorghum, millet) rice (28%) and cotton (19%). Other crops that are cultivated are niébé, cassava, fonio, vegetables and citrus for family consumption. Livestock production is an important activity. Tambacounda and Kidira is an important livestock zone which has 120.000 head of cattle and 70.000 of small ruminants.

South of Tambacounda there are large herds of 470.000 head of cattle of which 220.000 are used for animal traction and 280.000 small ruminants.

Senegal Oriental Soil resource management

Eastern Senegal is less densely populated and has more rainfall. It is dominated by shallow and stoney soils on lateritic pans. Land appears to be vacant north of Tambacounda, because local farmers have already abandoned it, after exhausting its limited soil fertility over the past 20 years.

The area around Kedougou could support an expansion of dryland cropping, because of the development of the necessary infrastructure and the installation of technical and social services in the area. Migration of farmers to bottomlands with deep deposits of alluvial soil, and which are flat and rock-free.

The South eastern part of Eastern Senegal is vulnerable to water erosion if the ground is bare. Eastern Senegal's soil management problems are less severe than those in the Peanut Basin, because bush fallows up to 5 years are still practiced. The population pressure is concentrated only in the Tambacounda region and the rainfall is 800 mm. More responsive crops such as maize and cotton are grown in rotation. Subsidies are available for cotton. Most

villages have significant areas of range land for cattle and there is sufficient "internal transport" of nutrients by cattle to maintain village farms. Peanut hay and cotton seed which are rich in nutrients are available for fattening of cattle.

ISRA's Long-Term Research Program Objectives

Long-term research objectives of ISRA for this zone are:

- An identification of constraints of Natural Resources Study. Evaluation of the degradation level.
- A study of the soil evolution and functions.
- An analysis of the land use system with the water and soil management.
- An economics analysis of the technical and management cost of the Natural resources.
- An announment of impact of the Land Management.
- A study of regeneration of soil degradation
- A regionalized study of soil fertilization
- A study to improve the production and use of animal manure.
- A study to improve and manage fallow.
- A range management study
- A study to support the farmer organizations, the use and evaluation of the appropriated technologies and better management of Natural Resources.

Lower Casamance Zone (Ziguinchor)

With almost 900.000 inhabitants, the South West Casamance represents 14% of the total population of Senegal. The low population growth rate is caused by the migration and the rural exodus.

The South West Casamance has important natural resources (water, soil, vegetative biomasse and animals), which could be intensively used. The arable land covers 750.000 ha which represent 20% of the total national land area.

The rainfall is between 800 to 1200 mm and this offers important water resources, in spite of the reduced rainfall, low flow of water and the increased water salinity. The result of these changes were crop diversification. Rice is the principal crop (78% of the national total cultivated land). Other important cultivated crops are citrus (60%), cotton (20%), maize (40%), sweet potatoes (22%),

peanut (12%), millet (10%), cassava (8%), vegetables (5%) and niébé (5%).

Casamance soil resource management

The flooded rice and salt dam soil management system is unique to the Casamance. Rice is not irrigated but flooded by means of catching rainwater and controlling surface flow of runoff water. These soils are subject to dry season salt water intrusion. As a result of high levels of sulfides in the soils, which are low lying they are vulnerable to acidification if subjected to prolonged drying.

Rice production depends on an annual flushing of salt from the soils where sea water intruded. If rainfall is insufficient this process will not wash out the salt and reduced rice production is the result. Because of insufficient rain the flow of fresh water to rice producing areas has been reduced.
The ability to structurally control the flow of fresh water to flush the salt water in these soils represents an improvement over total dependance on rainfall and runoff. Thus traditional knowledge of soil management practices can be used to boost yields and obtain significant returns quickly. Vulnerable soil resources can be saved from severe degradation by salinisation and acidification. Traditionnally salt-dams were used to enhance rice production but reduced rainfall have made these methods of water control less adequate.

Water erosion is an other problem. As a result of the salinisation of lowland rice soils, farmers have moved to upland soils which are vulnerable to erosion. The soils of Upper Casamance are shallow soils on lateritic hardpan which are quickly destroyed if cleared and left exposed to rainfall. About 75% of the cultivated land in the lower Casamance is now plateau land. In the Middle Casamance peanuts are more important than rice. Other plateau crops are millet, sorghum, maize. Extensive agriculture is dominant on the plateau, only little fertilisers are used. The forest cover has been depleted as a result of agricultural expansion. The plateau areas, where animal traction has been adopted, are areas with the highest farm incomes. In contrast where swamp rice is cultivated to the exclusion of other crops, these areas have the lowest agricultural incomes.

Trees and crop interaction

Oxidization of plant materials can take place by burning, composting and animal feeding materials. Plant material oxidizes slowly, and energy utilised by soil microbes benefits soils and crops. Mulching (compost or crop residue) effects only the surface of the soil, it is to conserve the soil, it improves the soil environment for root and microbal activity, it shades the soil and protects it from wind erosion and it improves water percolation. Mulching is not done by traditional farmers because it could be a habitat for pests. Farmers prefer to burn crop residues and make

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plant nutrients immediately available for the new crop. Millet-stalks cover the field in dry season and serve as protection for wind erosion.

Livestock

It is recommended to integrate livestock and crop production in order to improve the management of plant nutrients on the fields. Most farmers do not own sufficient animals to drastically improve their soil. Manure, which is used to improve crop nutrition, is poor if feed is of poor quality. Three ways to integrate animals and crop production are:

(1) animal traction

(2) parking of animals on fields, to concentrate plant nutrients from range land on crop land for the benefit of the crops.

(3) fattening livestock

ISRA's Proposed Research Activities are:

- An identification of constraints of the Natural Resources. Evaluation of the degradation level.

- A study of the soil evolution and function with the technical itineraries.

- An analysis of the land use system with water and soil management.

- An economic analysis of the technical and management of the Natural resources.

- An assessment of impact of the Land Management at the various scales.

- A study of regeneration of soil degradation

- A regionalized study of the soil fertilization

- An study for improvements of the production and the animal manure.

- An study to improve and manage fallow and range management.

- A study to support the farmer organization for the use and evaluation of the appropriate technologies and for better Management of Natural Resources, recuperation of the salinised lands, and intensification of the rice crops.

Trees and forest resource management:

Management of forest resources is largely executed by projects.

Prior to 1933 each village managed their forests and woodlands. After 1933 all trees became the property of the State. Traditional use rights i.e. gathering of medicinal products and dead wood were recognized. Villagers consider forest and woodlands as commons with access to forest limited. Enforcement of regulations depends on the forestry services. Management of local grazing resources consisted of continuously moving animals to grazing areas and allowing plants to recover.

Traditional resource management:

The Serer had a mixed farming system using Acacia Albida and other soil building trees and shrubs and fallow with animals integrated into the farming system.

However population and migration increased. Also animal traction and fertilisers changed the system however some aspects remain. Use of animals integrated in the system has declined, because of lack of pasture which was formerly provided by the fallow lands.

Research on forest resource management:

Natural forest management research includes fast growing species for fieldwood.

Agroforestry research on alley cropping and maize intercropped with varying fertiliser levels (superphosphate) was done by ILCA and FAC. Off-station research is done in selected villages, including live fencing and planting on the plateau above rice fields to reduce siltation problems.
There are several research gaps that exist at present i.e. proper silvicultural treatment of Casuarina equisetifolia (filao) and other trees Shrubs. The marketing and demand of eucalyptus roles is less well known.
Other knowledge gaps are the species which work best for a particular intervention in each specific ecological zone.

Natural resources management:

There were two technical Ministries managing Senegal's natural resources, they are: Ministère du Développement Rural (MDR), Ministère de la Protection de la Nature (MDR), Ministère de la Protection de la Nature et de l'Environnement (MPNE). The responsibilities of MPNE were divided into four directions. The Direction for reforestation and soil conservation was divided into two divisions which were placed under the Direction for Forestry, fisheries and wildlife and under MDR.

Problems exist in getting government offices to work together in extending information and receive feedback from farmers. Some examples are lack of coordination between technical services,

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failure to consider the needs of the farmers, lack of cooperation between local authorities and other levels of GOS. There is also a need for donor coordination and long-term planning.

The New Agricultural Policy does not address the problems of livestock or forestry sectors but only agricultural production.

The Code Pastoral prohibits farmers from excluding livestock from his fields after harvest of his crops. This provision may discourage tree planting for fair that they will be damaged by animals.

Natural Resource Management Constraints

Some of the Natural Resource Management constraints are mentioned in the Forestry Master Plan list. They are the following:

Natural constraints: Ecosystems that are sensitive to any modification of the existing vegetation. Poor soils and rainfall that is often highly variable causing abrupt and unfavorable climatic variations.

Human constraints: Pressure on the woody plant cover around urban zones and in the heavily populated rural areas i.e. direct consumption of wood, agricultural clearing, overgrazing, and the non-integration of agriculture and livestock. Lack of interest by the population in activities long term and without immediate returns. This inhibits the farmers' interest in trees.

A domestic economy that is not well managed and is wasteful of resources. Excessive consumption of fuelwood and charcoal. Slow adaptation to new conditions by the population.

Institutional constraints: The National domain is difficult to interpret and lacks detail concerning public and private forest investment. (The bulletins which interpret the law have not been published). This law makes the Rural Community the sole intermediate of the Administration for the planting, management and harvest of village forests. There is a lack of qualified personnel and sufficient equipment within institutions nationally, regionally, and locally.

Problems of the zone North Central Peanut Basin

General environmental degradation; decreased rainfall, deforestation, over-exploitation of the soils, decreased fertility, erosion.

Institutional problems are: lack of an integrated strategy for development and lack of coordination in the dialogue between technical services and the rural population, insufficient water resources, lack of credit.

Problems of the South Central Peanut Basin

The problems of the South Central Peanut Basin can be divided into 4 categories: environmental, agricultural, livestock and trees and forests.

The environmental problems are:

Poor soils, lack of nutritive elements and weak capacity to retain water, deforestation of the Acacia albida and overuse of Acacia seyal and others for firewood and charcoal and erosion.

The agricultural problems are:

Lack of farm equipment and organic and mineral fertilisation, (Although the South Central Peanut Basin uses better fertilisation practices than the north), poor soils and absence of fallow areas.

The livestock problems are:

Lack of grazing areas: herds are obligated to move to the Ferlo in the rainy season. Need research on animal nutrition there is insufficient feed during the dry season which calls for overuse of trees for forage.

The problems for trees and forests are:

Seasonal pruning of trees and exploitation or abuse and uncontrolled use of certain species for firewood charcoal.

Proposed solutions and recommended actions

ISRA staff recommended the following activities to resolve some of the mentioned constraints:

ISRAS'S RECOMMENDATIONS FOR SOIL AND WATER MANAGEMENT RESEARCH IN PROJECT ZONE

LISTE DES ACTIVITES DE RECHERCHES A MENER

Intitulé	Zones concernées
1. Inventaire régionalisé des ressources naturelles - Evaluation du niveau de dégradation	CNBA (1), CSBA (2), SO+HC (3) et SOC (4)
2. Etude de l'évolution des sols en fonction des itinéraires techniques	(1), (2), (3), et (4)
3. Mise au point de référentiels techniques de longue durée : quantification de leurs effets dans différentes situations agroécologiques	(1), (2), (3), et (4)
4. Récupération des terres salées (utilisation de plantes halophyles fourragères; mise en valeur sylvo-pastorale)	(2) et (4)
5. Gestion de l'eau en amont des aménagements hydro-agricoles	(4) et éventuellement (2)
6. Etude de l'érosion éolienne : quantification et méthodes de lutte	(1), (2)
7. Analyse du système foncier en relation avec la gestion de l'eau et du sol	(1), (2), (4) et éventuellement (3)
8. Analyse socio-économique des aménagements et des techniques de gestion des ressources naturelles	(1), (4) et éventuellement (3)
9. Evaluation de l'impact des aménagements à diverses échelles	(1), (2), (3) et (4)
10. Régénération des sols dégradés s'appuyant sur une valorisation des ressources naturelles disponibles (résidus de cultures, arbres, phosphates naturels, coquillages, etc...)	(1), (2), (3), (4)
11. Etude régionalisée de la fertilisation organo-minérale des cultures	(1), (2), (3), (4)
12. Intensification de la riziculture de vallée	(4).

13. Amélioration de la production et de la gestion des déjections animales (fumier + énergie)	(1), (2), (3) et éventuellement

CNDA (1); CSDA (2); SO+HC (3); and SOC (4)

Intitulé	Zones concernées
14. Amélioration des modes d'utilisation et de gestion des animaux de trait	(1), (2), (3) et (4)
15. Amélioration et gestion des jachères	(2) et (3)
16. Gestion de l'espace pastoral et amélioration du bilan fourrager	(2) et (3)
17. Appui aux organisations paysannes pour l'adoption et l'évaluation de technologies appropriées et pour la mise en oeuvre des régles de gestion des ressources naturelles	(1), (2), (3), (4)

(1) CNBA = Centre Nord Bassin Arachidier
(2) CSBA = Centre Sud Bassin Arachidier
(3) SO+HC = Sénégal Oriental et Haute Casamance
(4) SOC = Sud-Ouest Casamance

RECHERCHES PREVUES DANS LE PROJET AGRONOMY

1 - Dans le domaine agronomique

- Sélection et diffusion en milieu paysan de variétés améliorées adaptées aux différents types de rizicultures;
- Evaluation et tests d'adoption de techniques de lutte efficaces contre les principaux ennemis des cultures (insectes ravageurs, maladies et adventices);
- Recherche d'une technique saisonnée de fertilisation par l'utilisation des ressources naturelles disponibles;
- Evaluation de l'intérêt de certaines techniques culturales (présubmersion, drainage, chaulage, paillage, billonnage) dans la lutte contre la toxicité ferreuse, la toxicité aluminique et la salinité;
- Tests et évaluation pour l'adoption de matériel divers pour la mécanisation en traction animale des opérations culturales (labour, semis, sarclage et buttage);
- Suivi et évaluation d'une chaîne de matériel à traction animale adaptée à la riziculture de bas-fond;
- Phytotechnie et évaluation multilocale en milieu réel pour une meilleure combinaison des différentes techniques d'intensification.

2 - Systèmes de production comprenant l'élevage

- Poursuite et extension de l'analyse des systèmes de production et étude de la gestion des terroirs villageois en Casamance;
- Suivi de l'évolution et recherche de moyens d'améliorations des itinéraires techniques;
- Identification et analyse des organisations paysannes;
- Suivi zootechnique du cheptel en Casamance et recherche pour l'amélioration de l'alimentation et du suivi sanitaire des animaux;
- Evaluation et amélioration de la technique de parcage du bétail sur les parcelles de culture des céréales.

BASSE CASAMANCE

5. PROBLEMATIQUES DE LA GESTION DES RESSOURCES NATURELLES (Activités de recherche prévues dans le Projet)

Au stade actuel de la recherche entamée au niveau de la région, plusieurs problématiques se posent et mériteraient d'être prises en compte en vue d'une amélioration de la production céréalière et de trouver les moyens d'accroître les revenus agricoles des exploitants par le biais de technologies intégrées et adaptées.
Au vu des résultats obtenus sur le terrain par l'équipe systèmes en relation avec le machinisme agricole et les thématiques, un accent particulier doit être accordé aux deux grands thèmes suivants :

1. Analyse et Amélioration des systèmes de cultures en Basse Casamance;

2. Analyse et Amélioration des systèmes d'élevage.

5.1 L'analyse et l'amélioration des systèmes de cultures céréalières

5.1.1 Extension et diffusion de résultats de recherche: Un certain nombre d'innovations techniques ont déjà fait l'objet de tests en milieu paysan. La plupart d'entre elles ont passé les tests de faisabilité, de rentabilité financière et d'acceptabilité. Par conséquent, l'accent sera mis autant que possible sur la proposition de solutions alternatives, de manière à proposer à chaque catégorie d'exploitation agricole les technologies dont elle est en mesure de s'approprier.

Les actions porteront sur:

A. Productions végétales

1. Maïs : Amélioration des itinéraires techniques du maïs en plein champ et champ de case (labour + semis); fertilisation organo-minérale; sarclo-buttage etc..

2. Mil/Sorgho : Amélioration des itinéraires techniques du mil en champ de case et en plein champ (labour + semis; fertilisation organo-minérale; techniques de lutte contre les mauvaises herbes).

3. Riz : Amélioration des itinéraires techniques du riz (labour en lignes + semis, fertilisation organo-minérale; techniques de lutte contre les mauvaises herbes avec sarclages précoces, mécaniques, herbicide).

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5.1.2 L'expérimentation et la mise au point de solutions: Un certain nombre de thèmes techniques ont besoin d'être approfondi avant de passer à la phase de diffusion. Les résultats attendus à ce niveau porteront sur l'identification d'alternatives de solutions aux différents problèmes et contraintes recensés au niveau des exploitations.

Il s'agira 1) de trouver des variétés de maïs, mil sorgho adaptées du point de vue de leur cycle végétatif, de la tolérance aux contraintes physico-chimiques et biologiques, 2) de préciser les techniques culturales mieux adaptées aux conditions locales.

1. Riz : Amélioration du matériel végétal par l'introduction de variétés améliorées et adaptées.
Fertilisation à base de ressources naturelles : fumure organique, culture en couloirs avec les légumineuses.
Mise au point et test de matériels agricoles sur billons pour augmenter la productivité de la main-d'oeuvre (Semoir, butteur).
Essai et suivi d'un motoculteur en gestion paysanne dans le but de proposer des techniques culturales en relation avec le choix des équipements, associés au niveau d'équipement des paysans etc..

2. Maïs Amélioration du matériel végétal par des tests d'adaptations de variétés améliorées.
Fertilisation organo-minérale mettant à contribution les déchets animaux et espèces fixatrices d'azotes cultures en couloirs avec les légumineuses.

3. Mil/sorgho: Idem Maïs

4. Gestion des terroirs: Recherches adaptatives pour l'amélioration au niveau du terroir (fertilisation, techniques culturales, assoleurs, asssociation de culture, etc...).

5.2 Analyse, étude, amélioration des systèmes d'élevage

Il s'agira de mettre l'accent sur:

1. Les tests de démonstration de suivi sanitaire et du logement des animaux de trait.

2. Les techniques de gestion des parcours et alimentation du bétail.

3. Les techniques de rations d'engraissement des porcins.

4. Evaluation et amélioration de la technique du parcage du bétail sur les parcelles de maïs.

SENEGAL ORIENTAL ET HAUTE CASAMANCE

6. Activités à mener dans le Projet

Les activités de recherche doivent être fortement amplifiées dans la région pour l'élaboration d'un ensemble programmé de propositions concrètes et efficaces capables d'assurer le succès des nouvelles stratégies d'intervention des organismes et structures d'encadrement des producteurs. Elles auront pour objectifs :

a) le développement et l'intensification raisonnés des productions à potentiels élevés dans chaque secteur rural de la zone selon les vocations agricoles conformément aux objectifs et orientations assignés par la Nouvelle Politique Agricole;

b) la mise au point de techniques de préservation et de restauration des ressources naturelles;

c) la définition de voies et moyens (méthodes d'approche) d'intégration de ces différentes ressources pour une agriculture plus productive et plus sécurisante.

BASSE CASAMANCE

V. ACTIVITES DE RECHERCHE PREVUES DANS LE PROJET

5.1 Agronomie

a) Riziculture

Sélection/diffusion amélioré en milieu paysan.

En amélioration variétale et physiologie:

- Poursuite de l'étude des collections et étude génétique en vue d'accroître les possibilités d'obtention d'un matériel végétal mieux adapté aux variations de submersion.

- Poursuite de la création variétale ou hybridation et sélection sur les descendances et sur du matériel introduit de l'ADRAO.

- Evaluation de la tolérance variétale aux phénomènes de toxicité (fer et aluminium), à la salinité et à la sécheresse (approche physiologique).

. En phytopathologie/entomology control:

- Suivi des sélections en cours et évaluation du comportement du matériel vis-à-vis des principales maladies.

- Evaluation de la résistance à la pyriculariose, des variétés sélectionnées en essais préliminaires de rendement. Ceci par rapport à différentes souches de Pyricularia Oryzae et sous conditions variables du milieu, de la fumure azotée et du régime hydrique.

- Étude de la résistance variétale aux autres maladies; analyse de la pathoflore des semences et recherche de moyens d'améliorer leur qualité.

- Etude approfondie de l'influence de la fumure azotée et de la variation du régime hydrique sur le développement de la pyriculariose ou d'autres maladies.

En Entomologie:

- Etude de la résistance variétale du riz aux principaux insectes ravageurs.

- Etude approfondie des relations population de chilo et dégâts sur riz et détermination d'un seuil critique de nuisibilité ou d'intervention.

. En malherbologie:

- Etude des phénomènes de concurrence des adventices en relation avec les conditions de submersion, les niveaux de fertilisation et les techniques de semis.

- Etude de la biologie et de l'écologie des espèces adventices de riz sauvage et de certaines appéracées particulièrement nuisibles en vue de la recherche de méthodes de lutte efficace et économique.

- Poursuite de l'expérimentation des herbicides en mettant l'accent sur la combinaison de plusieurs matières actives pour améliorer l'efficacité et réduire les coûts des méthodes existantes et répondre à la demande croissante de l'encadrement et des paysans.

- Elaboration et évaluation en milieu paysan de techniques de lutte intégrée contre l'enherbement par la combinaison de techniques culturales adaptées avec la lutte mécanique et l'utilisation réduite d'herbicides.

. En agropédologie et fertilisation:

- Recherche d'une technique raisonnée de fertilisation par l'utilisation des ressources naturelles disponibles (phosphates naturelles, paille de riz, déchets animaux).

- Cultures en couloirs, associations culturales, rotations culturales.

- Evaluation de l'intérêt de certaines techniques culturales (présubmersion, drainage, chaulage, paillage, billonnage et fertilisation potassique) dans la lutte contre:

  - la toxicité ferreuse
  - la toxicité aluminique
  - la salinité

. En machinisme agricole:

- Tests de matériels divers pour la mécanisation, en traction animale, des techniques de préparation du sol.

- Mise au point de techniques de semis et de sarclage mécanique dans les rizières.

- Mise au point et test de matériel pour culture en billons pour augmenter la productivité de la main-d'oeuvre.

- Essai et suivi d'une chaîne de matériels à traction animale adaptée à la riziculture de bas-fond.

. Phytotechnie et évaluation multilocale et milieu réel et système de référence :

- Expérimentation multilocale pour l'évaluation en milieu réel de l'intérêt et de l'adaptabilité des produits et techniques mis au point.

  - Variétés
  - Protection de la culture
  - Fertilisation
  - Techniques culturales

- Recherche des meilleures combinaisons des différentes techniques d'amélioration de la productivité.

  - Densités culturales en relation avec les caractéristiques variétales.
  - Techniques de mise en place de la culture.
  - Evaluation des itinéraires techniques et actualisation des fiches techniques de conduite et de gestion de la culture.

b) <u>Maïs</u>

- Amélioration variétale: Tests d'adaptabilité de variétés sélectionnées provenant des programmes de recherche sur le maïs basé à Bambey et St-Louis.

- Recherche pour l'amélioration de la fertilité des sols par apport organique et détermination des conditions d'une meilleure efficience de la fumure minérale.

- Mise au point de techniques adaptées de protection de la culture contre les principaux ennemis (maladies, insectes et mauvaises herbes).

- Essai de mécanisation à traction animale bovine de certaines opérations culturales en vue d'améliorer la productivité du travail.

c) <u>Mil et sorgho</u>

- _____ d'adaptabilité de variétés pour l'obtention de matériel plus productif que les variétés locales et ayant un bon comportement vis-à-vis de certaines contraintes:
  - principaux insectes et maladies
  - striga
  - sécheresse

- Amélioration de la fertilité des sols par la valorisation des ressources naturelles.

- Mécanisation de certaines opérations culturales

- Suivi et évaluation du problème Striga et recherche de solution.

5.2 Systèmes de productions comprenant l'élevage

- Poursuite et extension de l'analyse des systèmes de production sur l'étude Gestion des terroirs villageois en Casamance.

- Expérimentation et adaptation de solutions aux contraintes diagnostiquées dans les différentes situations agricoles.

- Suivi et recherche de moyens d'amélioration des itinéraires techniques pour les cultures de plateau et pour la riziculture.

- Suivi et évaluation du programme DERBAC de mise en place des bergeries (élevage).

- Suivi zootechnique du cheptel en Casamance.

- Evaluation et amélioration de la technique de parcage du bétail sur les parcelles de maïs.

- Tests de démonstration de suivi sanitaire et d'alimentation des animaux de trait.

- Techniques d'engraissement des porcins.

- Techniques agricoles.

- Consolider les organisations d'élevage.

SINE SALOUM

Activités à mener dans le cadre du projet

- La préparation du sol : Elle doit être étudiée en fonction du matériel, de la force et du temps de travail disponibles au niveau de l'exploitation.

- Densités et modes de semis : doivent être redéfinis en fonction des ressources en eau et des stratégies de lutte contre les mauvaises herbes.

- Dates de semis : elles doivent être revues en fonction de la gamme des longueurs de cycle des cultivateurs disponibles.

- Rotations : il faut concevoir des systèmes de cultures qui permettent la sécurisation des rendements des successions culturales, l'amélioration de la fertilité du sol et un calendrier cultural praticable par le paysan.

Résultats attendus

Mettre au point ou réajuster des méthodes culturales qui augmentent la production agricole (Surtout céréalière) tout en préservant et/ou améliorant le patrimoine foncier des exploitations.

AGROFORESTRY

Activités proposées dans le cadre du projet ISRA-USAID

Le caractère pluridisciplinaire de l'agroforesterie exige non pas une juxtaposition de données sectorielles mais plutôt une démarche concertée et une approche globale des contraintes et solutions à proposer. Il convient également, dans ce genre d'étude, de bien cibler les objectifs prioritaires afin d'éviter une dispersion des moyens.

A l'issue de l'étude réalisée conjointement par l'ISRA et l'ICRAF avec le Groupe national de Travail (équipe pluridisciplinaire), des propositions de recherches agroforestières ont été faites pour chacun des systèmes d'utilisation des terres identifiés (cf. ISRA-ICRAF, juin 1990). Les mêmes propositions peuvent être reconduites dans ce projet. Il faut préciser que le projet ISRA/ICRAF n'intervient que dans la zone semi-aride du Sénégal.

a)- Recherches à approfondir en agroforesterie

1. Etude approfondie du milieu à l'échelle nationale par la méthode du micro D & D et la connaissance des modes traditionnels de gestion des systèmes d'utilisation des terres.

2. Recherches sur les systèmes à parc

Ces parcs nécessitent d'être mieux connus quant à leur structure, composition, regénération pour la proposition de modes d'aménagement susceptibles d'assurer leur pérennité. Des méthodes de quantification des différents produits et sous-produits forestiers méritent d'être recherchées pour déterminer de manière exacte la possibilité de ces peuplements. Enfin l'influence des espèces composant les parcs sur le rendement des cultures et les modes de gestion les plus appropriés pour ces espèces devront être déterminés.

3. Recherches sur les haies vives et les brise-vents

Les essais suivants doivent être poursuivis et approfondis :

- essais d'introduction et de sélection d'espèces susceptibles de bien se comporter en plantation en lignes denses monospécifiques ou plurispécifiques sur la base de caractéristiques écologiques requises pour les différents sites où elles sont introduites;

- essais sur les modes de gestion des haies vives en ce qui concerne :

  - la fréquence et les périodes de coupe les plus appropriées;

  - la hauteur des premières coupes pour une meilleure impénétrabilité (haies vives);

  - les meilleures périodes de coupe pour assurer une bonne regénération par rejets et un maximum de produits;

  - la productivité des haies vives et des brise-vents;

  - l'utilisation des produits

  - essai association d'espèces :

  - croissance des espèces

  - concurrence entre les espèces composant les haies vives et les brise-vents

  - concurrence entre espèces ligneuses et cultures.

  - étude de l'influence des brise-vents sur le climat (réduction de la vitesse des vents, de la température, de l'ETP...)

4. Essai sur les cultures en couloirs

- introduction d'espèces diverses pour étudier leur comportement

- quantification de l'engrais vert en fonction des écartements et des régimes de coupe

- hauteurs et périodes de coupe pour une production optimale d'engrais vert

- l'effet mulch sur la fertilité des sols et sur les rendements agricoles

- épandage et/ou incorporation de l'engrais vert

5. Essai sur les banques fourragères

- introduction d'espèces diverses pour étudier leur comportement

- quantification du fourrage en fonction des écartements et des régimes de prélèvements

- hauteurs et périodes de coupe pour une production optimale de fourrage

- étude phénologique des espèces fourragères

- tests d'appétabilité, de digestibilité ainsi que des études de valeur bromatologiqeue sur des espèces ayant un bon comportement

- possibilités de regénération par rejets d'espèces fourragères intéressantes

Dans la zone sylvo-pastorale, il est nécessaire de mener des essais d'aménagement de l'espace pastoral avec, au préalable :

- l'inventaire des ressources disponibles (pâturage, eau, sol, cheptel, ressources humaines, produits forestiers...)

- le diagnostic de l'occupation de l'espace pastoral et son état actuel (identification des contraintes socio-économiques et socio-politiques)

6. Essais sur les jachères améliorées

- introduction d'espèces diverses (essai comportement)

- influence des espèces sur l'évolution de la fertilité des sols

- hauteurs et périodes de coupe pour une production optimale d'engrais verts

- méthodes d'épandage et/ou d'incorporation de l'engrais vert.

7. Etude sur les parcours naturels

- caractérisation des différentes formations forestières : structure des peuplements, relations allométriques entre productivité et différents paramètres des espèces ligneuses, détermination de la biomasse fourragère totale et de la biomasse appétée.

- effet de différents traitements sur l'évolution des espèces ligneuses (effeuillage, émondage).

- effet du broutage sur la régénération des ligneux (relations entre charge animale par espèce/évolution de la composition et de la structure des peuplements ligneux).

- effet du transit digestif sur la germination des semences d'espèces ligneuses fourragères.

- étude de la valeur alimentaire des ligneux : poursuite des études en cours (analyses chimiques, digestibilité in-vivo en insistant sur l'appétabilité et la toxicité potentielle des espèces consommées à différents degrés, dégradabilité in sacco...).

- préciser les relations valeur alimentaire/stade phénologique en vue d'identifier les périodes optimales de récolte.

- étude sur l'intérêt nutritionnel des espèces fourragères introduites.

- poursuite des essais d'introduction d'espèces fourragères.

- étude sur les méthodes d'application en milieu réel des résultats obtenus en station.

- essai de gestion d'espèces fourragères en milieu réel.

- étude sur le comportement animal vis-à-vis des espèces dans des ensembles phytosocioécologiques différents.

Natural Resource and Crop Technologies identified by ISRA for addressing these problems include:

Improved fallow systems using trees, shrubs, grasses and/or legumes: (Central-Southern Peanut Basin, Senegal Oriental, Casamance): The main objective of improved fallow systems is to introduce woody perennials, grasses and/or legumes into farming systems to enhance soil fertility, organic matter content and/or provide a degree of substitution for inorganic or chemical fertilizer. The project will assist ISRA in identifying and testing species that are not allelopathic and capable of providing substantial quantities of green manure in relatively short periods of time. Secondary benefits might include increased fuelwood and forage supplies and perhaps some soil stabilization. Farmers in some areas are already managing a number of trees and shrubs with the express intention of improving soil fertility and/or stemming erosion and ISRA will draw on this indigenous knowledge.

Composting (all regions): There is much accumulated evidence in Senegal that composting can enhance crop yields. Compost applied at 10 tons/ha has been found to provide sufficient nitrate to millet in the Peanut Basin for increased yields. Rock phosphate (local) composting has been shown to increase the available phosphate for plant uptake to levels comparable to single superphosphate responses. The key in wider adoption of composting technologies will be to use (or increase the supply of) locally available composting resources and resolve transport issues (e.g., field composting vs. compound composting).

Alley cropping (Senegal Oriental and Casamance): Alley cropping is an agroforestry technique developed by IITA in which crops are grown between lines of leguminous trees and shrubs. These latter are coppiced and managed for their green manure input. The objective is to have a fallow system on the field at the same time as the crops rather than sequentially. Alley cropping methods can also provide erosion barriers using species selected for their compatibility with the different farming/cropping systems. ISRA has already gained some experience with alley cropping in the lower Casamance and the technique is also applicable to other higher rainfall areas such as Senegal Oriental and high and middle Casamance. Given the large differences between farming systems in the region, research on appropriate labor intensity factors and technology (rotation) succession should guide the choice and sequence of technology components (species and spacing).

Line plantings (North-central Peanut Basin): Line plantings are an adaptation of the alley cropping agroforestry system developed by IITA but more suitable for drier areas. Lines of trees are established in wide bands within and between row spacings and crops are grown within the lines. Trees are coppiced during field preparation and allowed to remain on the fields until leafy matter (leaf litter) and fine branches fall and are turned into the soil. Larger branches are used for firewood and/or service wood. This technique has the potential of eliminating the recurrent problem of natural regeneration being destroyed by field preparation, crop

cultivation and harvesting; Rows of trees would be visible and are much easier seen by those preparing or harvesting fields. Trees will not interfere as much with animal traction. As in the case of improved fallow, a better understanding of traditional organic matter management systems, will be a key in developing line plantings as a research objective.

Organic and mineral fertilizer combinations (All regions): Research directed toward increasing organic matter content of the soils (e.g., agroforestry, composting, intercropping, etc.) needs to be combined with research on fertilizer applications and efficiency, particularly the use of local fertilizer resources (rock phosphate). Socio-economic research is critical in identifying which techniques are most acceptable to farmers. Improved organo-mineral soil technologies may involve significant labor, energy and cash expenditures, which are some of the obstacles to adoption. Other obstacles to consider are the turn around and the fact that the majority of crop residues are used for off-farm purposes. Some of the in-the-field residues are usually burned before soil preparation. Timing of incorporation of residues is important, because organic matter undergoes an initial phase of rapid microbial degradation. This actually ties up soil nutrients, making them unavailable to plants. Under hot weather conditions prevalent in the rainy season rapid mineralisation follows which results in large nutrient losses due to leaching (washing out). Ideally, crop residues and animal manure should be incorporated in the soil right after the animals have grazed the harvested fields.

Research on organic mineral fertilizer applications includes searching for the correct fertilizer combination for each crop and soil type in a particular socio-economic setting. Nutrients and optimum time of application for each crop and sequence (residual effects), needs to be identified and tested under farm conditions.

(2) Watershed management (Southern Peanut Basin and the Casamance)

Water erosion in Senegal may be attributed to a large extend to vegetation loss. Farmers often attribute vegetation loss to climatic change. However, human activity appears to be the dominant cause. Trees and shrubs are cut for firewood, animal feed or to facilitate mechanized tillage in spite of farmer awareness of erosion problems and Eaux et Forets interdiction. Vegetation removal is a more serious problem in the southern portion of the Peanut Basin and in the Casamance, where fairly large areas of unexploited land still exist.

The introduction of animal traction and mechanized tillage without accompanying soil conservation measures also contributes to increased soil erosion. Discussions with farmers in the Southern Peanut Basin indicate that their erosion and soil loss problems began soon after mechanization. As one farmer puts it, his yield per hectare now has decreased, but with mechanization he is able to cultivate three times as much land so that his total production is higher.

Population increases have led to more and more land being cleared for crop production each year. The net result is extensive loss of protected soil by vegetation and reduction of soil maintenance through the traditional fallow system.

Agronomic practices also leave the soil exposed to the effects of wind and water and this leads to internal changes in the soil which reduce the soil's resistance to erosion. Almost all crop residues are taken away from the fields for construction (e.g., millet straw for thatching and fences) or for animal feed (peanut and cowpea hay). The result using crop residues for other purposes than organic matter is twofold: First, no protection is being offered to the soil; second, with limited organic matter being returned to the soil, it loses its resistance to erosion. Soil structure may also be damaged by tillage. The complete removal of peanuts, including the roots, is often cited as disturbing the soil and destroying soil structure, leaving the soil open to erosion.

The results of agronomic practices and expansion of cultivated areas, throughout the project area, have been to expose larger areas to the impact of wind and water erosion and simultaneously reducing the soils' resistance. Evidence of use of simple methods of protective agronomic practices by farmers such as contour land preparation is lacking. Farmers in the Sine Saloum and Casamance continue to cultivate up and down the slope this encourages run-off and channel flow.

Surface water flow and run-off, where rainfall exceeds the infiltration capacity of the soil becomes more apparent in the southern Peanut Basin and in the Casamance where rainfall is higher. Despite the sandy nature of the soils i.e. in Sine Saloum, water infiltration is reduced because of structural breakdown and the tendency of these soils, when exposed to rain and sheetflow, to crust and seal. The amount of run-off and erosional damage on even very slight slopes (<1%) can be very severe. As rainfall increases (i.e., the Casamance) the problem becomes more critical.

In the South of the Peanut Basin and the Casamance, the water flow can become strongly channelized and severe gully erosion is the net result. The gullies and the water flow and erosion of fields adjacent and upslope are of immediate concern to the villagers. While it is difficult to gage soil loss from sheet erosion, the majority of the fields in the southern PB are marked by drainage lines (channel flow). Channel flow begins with sheet wash, the removal of fertile topsoil, and washing away of manure and fertilizer. This again degrades the soil, and reduces its erosional resistance.

Of growing concern in the Casamance is increased siltation and salinization of rice fields which are primarily the result of loss of vegetative cover. Because of periodic and prolonged droughts reduced water flow and salinisation in the Casamance many farmers have migrated to the plateau areas. Extensive agriculture on the plateau and increased clearing of the forest cover and severe depletion is the result of this migration. Deforestation has created

downstream soil erosion and rice field siltation and a reduction in the fresh water underflow down into the lower valleys and it creates an alteration of the salt and fresh water interface. The result has been continued encroachment of salt water into the areas which are not protected by dikes or intrusion dams.

Erosion control technologies: A number of technologies exist which may be effective in controlling some of the water erosion problems. For effective conservation of soil and water, these technologies must be integrated on a watershed basis. The watershed is the natural unit for managing resources, especially overland water flow. Watershed management involves treatment of the entire watershed using a variety of integrated techniques. The techniques must be adapted to the ecological and biophysical conditions and socio-economic circumstances of the farmers living on the site.

Watershed management starts on the upper slopes. In certain areas (Sine Saloum, Casamance) these upper slopes consist of shallow soils over laterite. Retaining a permanent cover is important to prevent erosion and runoff. On the cultivated lower slopes, agronomic and agroforestry practices will often be sufficient to control runoff and erosion. In some areas, these techniques may need to be supplemented by physical barriers. Effective watershed management, will prevent runoff but safe water disposal or gully control structures can usually prevent damage.

Protecting only part of a watershed, (one or two fields), may exacerbate problems in unprotected areas. By working on a watershed basis, both soil and water can be conserved. This in turn allows the use of other measures and technologies to rebuild the soil structure.

Technologies (Natural Resource based)

Contouring: This practice involves performing field operations such as plowing, planting, cultivating and harvesting approximately on the contour. It has the potential of reducing surface runoff by trapping water in small depressions and avoids the development of rills or high water velocity which results in erosion.

Strip Cropping: This practice involves alternate strips of different crops on the same field following contours. In Senegal there are two potential problems with this practice. First, in order to reduce water runoff, crop stubble/residue must be left on the strips. However, most crop residue is used off-farm. Second, this technique is mostly practiced on large farms. On farms under 20 hectares,which are scattered in small plots around the village and it may be difficult to encourage farmers to test/adopt this practice on small fields.

Tillage Practices: Tillage is the mechanical manipulation of the soil to provide soil conditions suited to the growth of crops, the control of weeds and the maintenance of water infiltration capacity and aeration. Its purpose is to provide an adequate soil and water environment for the plant. The effect of tillage upon erosion depends on such factors as aggregation, surface sealing,

infiltration and resistance to wind movement. Where intensive or excessive tillage has destroyed the soil structure, increased erosion may result. Significant yield increases from on-farm and on-station research have been noted from deep plowing and tillage practices which are changing the structure of the soil, allowing better root establishment and improved water infiltration and storage. In drier areas, however, deep tillage has been implicated in increased wind erosion. It removes root regenerated shrubs which are often the only source of vegetative cover during the dry season.

Tied ridging: Tied ridges are essentially small depressions made between crop rows either by hand tillage or by a combination of hand tillage and animal traction. These depressions catch and hold water after a rain and increase water retention and infiltration. This technology has been proven to increase soil moisture levels and exchangeable Ca, Mg and K with corresponding increases in maize and cowpea yields particularly during dry years. Research issues regarding the use of tied ridges in Senegal are: they are extremely labor intensive and ridging does not work well on sandy soils.

Rock Bunds: Rock bunds are barriers 10-15 cm high made of laterite and/or rocks which are placed on field contour lines anywhere from 10m to 15m apart depending on the slope. The barriers are permeable and have the function of slowing down runoff and decrease erosion and facilitate increased infiltration. This technology has the advantage that is can be constructed in off-peak labor periods and is not as labor intensive as tied ridging. Rocks may not be readily available in some regions but often other materials can be substituted such as low fences made of branches twigs and earth (facines).

Minimum tillage/mulching: Leaving crop residues on fields, mulching and/or using minimum tillage methods can reduce rainfall runoff and increase water infiltration. However, the constraint of using this technique is the limited supply of crop residue. The demand for its uses as animal feed, fuel and for construction, leaves most fields bare before planting time. When crop residue is not all used off-farm, the prevalent custom is to rake it into a pile and burn it for quick nutrient release. Some preliminary ISRA research results in the Sine Saloum area suggest that millet and sorghum straw may be allelopathic and actually reduce crop yields. Another drawback is that mulch furnishes a good habitat for pests which are difficult to control without chemicals.

Vegetation barriers: Planting trees and shrubs on contour lines and placing debris strips behind these lines with branches from trees, can also effectively control runoff and increase water infiltration. Deep rooted perennial grasses such as vetiver (Vetiveria spp.) and Andropogon spp. can also make major contributions towards controlling soil erosion when planted on the contour. The stiff lower stems of these grasses act as a filter which allows excess water to drain while barring the movement of sediments and soil. Equally important, the dense narrow bands of grass slows down runoff so that much of the water of the short intense showers can soak into the soil before it starts to wash down

the slopes. Certain fodder grasses thrive well when combined with trees and shrubs. When combined with leguminous trees they can benefit from its nitrogen fixing capability. An advantage of these types of erosion control techniques is that they often provide substantial secondary benefits of increased fuelwood and fodder supplies.

Natural forest management: As stated above, watershed management begins at the top of the slopes. It is important that farmers retain a permanent cover in these areas in order to prevent erosion and runoff and to recharge groundwater aquifers. Instead of clearing the natural vegetation and establishing artificial forest to do this job, ISRA has been experimenting with natural forest management techniques on upper slopes in the Sine Saloum. ISRA worked in close collaboration with villages surrounding the hill. ISRA has demonstrated that simple protection of these areas (mise en defense), by the villagers, can reestablish these forests with a minimum cost. Biomass yields compared favorably with artificial plantations but yielded significantly greater secondary benefits (forage, fodder, medicinal plants, etc.) than artificial monocultures. Further research is required on how these forests can be more productive while providing sustained yields over time.

3. Animals in Farming Systems (All regions)

Discussions with ISRA staff at Bambey suggested that the role of livestock in the farming systems in the project area also merits additional research. Livestock has always played an important role in the Senegalese economy. During 1985-1987 the sector's contribution to GDP was estimated at 7.5%, and 35% of the primary sector. The importance of this sector is similar to agriculture which represented an average of 9% of GDP during the same period. In the project area, animal husbandry is traditionally extensive and productivity is generally low. Production of natural pastures (including crop residues, fallow fields and bas-fond areas) is generally low and support 2-7 ha/animal unit during the rainy season and 6-14 ha/animal unit during the dry season.

Livestock has important multiple functions in the cereals production systems in the project area. They provide meat and milk. Milk production is principally from cattle although goats are also milked in some areas. Livestock provides a ready means of savings. Oxen, horses and donkeys provide important sources of animal traction used in land preparation, planting and transportation and water handling.

From an ecological viewpoint, animals are indispensable in the propagation of a number of important tree species including Acacia Albida. Animals do a considerable amount of damage to natural regeneration of important on-farm soil conservation species through browsing.

The removal of fertilizer subsidies, increased the importance of livestock in integrated farming systems and the production of manure for use on crop fields. Traditionally, manure use in the project areas follows one or more of the following three "parcage" patterns: (i) confining a farmers own livestock on a particular field (usually millet) for several days; (ii) arranging with Pular herders to exchange crop residues left in the fields (and occasionally forage trees) in exchange for several days of livestock-manuring; (iii) collection of manure produced by animals around the compound and transported to the fields before planting.

In terms of NRBAR support to the role of livestock in the farming systems, two sub themes appear to emerge: (A) increase on-farm fodder supplies; and (B) improve traditional manure management systems.

(A) Increased on farm fodder supplies: (Central-South Peanut Basin, Senegal Oriental and Casamance) Improved management and pruning techniques (dates, rates, method, etc.) for indigenous on-farm fodder trees can significantly increase available forage/fodder resources. Fodder banks in and around compounds could be used to produce forage by using under-utilized soil nutrients and moisture. These forage resources could be either leguminous trees such as Leucaena spp. or forage grasses such as Pennisetum spp. or Andropogon spp. Leucaena can be planted densely in situations such as this and kept cut at a low height of one meter. Frequent cutting maintains a very high quality forage.

(B) Improved traditional manure management systems: The project should include an interdisciplinary study on traditional methods of manure use in farming systems in the project area with the objective of improving efficiency of existing systems (e.g., how to minimize nutrient loss due volatization, timing, etc.)

4. General Agronomy

The NRBAR Project assists ISRA in balancing its traditional commodity approach in cereals research (breeding varieties) with a new approach which emphasizes natural resources-based cereal research and related socio-economic research. Review of ISRA's commodity program suggests certain areas of assistance as follows.

Plant Breeding and Variety Improvement: Strengthening ISRA-IARC linkages (All regions): Commodity programs in most Sahelian countries continue to focus on plant breeding activities, despite the fact that historically these efforts have resulted in only marginal gains in yields at the farm level. There may be a variety of causes for this apparent failure: (i) relatively few improved varieties have been released from these programs and those that have been released have not often been adequately tested on-farm; (ii) improved varieties are not made available to farmers

(i.e. lack of seed production and distribution); (iii) the full potential of these improved varieties has not been realized because cultural practices were ignored due to a lack of knowledge of farmer's socio-economic constraints.

While the project will not fund varietal improvement (breeding) directly, the project will assist in two areas: (1) developing improved coordination between ISRA departments and stronger ISRA linkages with regional and international research organizations and networks, and (2) conducting on-farm varietal trials.

ISRA will improve the efficiency and effectiveness of natural resource based commodity research and on-farm testing and will resolve the above mentioned problems. The project will strengthen ISRA's linkages with regional and international research entities and networks. These linkages will assist ISRA to: (i) capitalize on the research conducted elsewhere which may have direct application to Senegal; (ii) improve the cost-effectiveness of research conducted by ISRA on intractable problems with little hope of breakthrough in the foreseeable future e.g.; millet varieties resistant to striga and tolerant to drought; high yielding varieties of millet with yield stability under farmers' management; peanut varieties resistant to leaf spot; rice varieties resistant to blast; and (iii) establish long term linkages with IARCS in the region to facilitate peer group review and interaction and exchange of information and experiences.

With regard to on-farm varietal trials, ISRA has developed a number of improved varieties of millet, sorghum, rice and cowpeas, in collaboration with centrally funded CRSP programs, the IARCs and regional networks. The project supports on-farm testing of the most promising cereal varieties in combination with natural resource based technologies under various farmer socio-economic constraints and cultural practices.

Crop Rotations (All regions): Crop rotation research conducted in Senegal showed desirable and undesirable crop-sequences for the cereals cropping systems. This information needs to be updated due to changes related to: (i) the reduction of fallow.(Fallow has increasingly disappeared or been reduced in length such that its positive effects are now minimal); (ii) the intensification and blending of cropping systems with natural resource technologies as a whole; and (iii) the prevalence of monocropping for several years in succession.

Rotation of cereals with non-cereals and particularly legumes needs to be evaluated in terms of current farming practices. Targeting organic matter production and nutrient availability within a particular rotation scheme would be particularly important. Socio-economic factors, as well as natural resources and agronomic factors need to be taken into consideration in designing on-farm rotation research. A long term research plan and commitment to this effort is required. Benefits from crop rotation, agroforestry, and soil improvement strategies are not evident over short time periods.

Crop Associations (All regions): Intercropping is traditionally used in much of semi-arid West Africa as a means of increasing total yield per unit area, and labor, and a means of reducing risk. Intercropping improves ground cover and protects the soils as the interplanted crops often have different growth periods. In moister areas, a forage crop can be interplanted late in the growing season to grow on residual moisture with the primary objective of providing soil cover after the harvest of the main crop. Intercropping is not widely used in Senegal, at the present, except for millet and cowpea around Thies, where the traditional practice is late overseeding of millet with cowpeas. The project supports a research experiment to assess the effects of intercropping on soil and crop productivity. A comparison of the benefits of intercropping vs. crop rotations using millet and cowpea could also be a topic of research.

Improved Animal Traction/Mechanization: Utilization of animals for cultivation can reduce human labor and increase farmers' efficiency and productivity. The blend of natural resources contributions with agricultural productivity and the increased use of animal traction is a two-sided issue. Animals are mainly used to expand the area cultivated and improve labor efficiency in maintenance of the crop which may lead to an increase in overall production rather than yield increases per hectare. In the Peanut Basin, for example, the increased use of animal traction to cultivate larger surfaces at the expense of fallow or previously uncultivated areas (primarily forests and rangelands) has been the biggest non-climatic contributor to loss of vegetation and resource degradation problems.

The type of traction used also has an impact. Some research suggests that continuous shallow tillage (5-10 cm), using horse drawn equipment can destroy soil structure and increase surface runoff and sediment erosion and eventually lead to reduced crop yields. Deep plowing using oxen-drawn equipment can improve soil structure and enhance water infiltration and the incorporation of organic matter but has been implicated in enhancing wind erosion/declining soil fertility as it permanently removes root regenerated vegetative cover. The high cost of purchasing and maintaining animals and more efficient equipment is a deterrent for many resource-poor farmers.

The NRBAR project increases use of animal traction/improved mechanization in the farming systems needs to take into account the issues and seek ways in which existing mechanization practices could be modified to better reflect natural resource concerns.

Research program objectives for specific Regions:

Some regional-specific research objectives which address a particular problem (socio economic) or appear to be targets of opportunity for further research follow.

A. North-central Peanut Basin (Thiès, Diourbel et Louga, Kaolack, Fatick)

Technologies:

(1) Improved pruning methods for forage trees: One of the major concerns in the NCPB today is what effect the more or less continuous pruning of Acacia albida (cad) is having on crop yields, and on the cad population in general. Farmers report that they have a decrease in crop yields when trees are severely pruned but argue that because of the lack of dry fodder reserves during poor rainfall years, they have no choice. Excessive/consecutive pruning of cad during poor rainfall years can also result in the death of the tree. There is a clear need for more information concerning pruning of cad and other forage tree species. In particular information/research is needed on timing (i.e.) season, age of tree and degree pruning severity in order to enhance future production.

(2) Direct seeding of A. albida vs. enhancing natural regeneration: ISRA has already demonstrated on-station that direct seeding of cad results in better tree survival and growth rates than planting container grown stock. This technology needs to be tested on-farm and should be compared with alternative methods of enhancing natural regeneration such as the use of composted seed and spreading.

(3) Windbreaks and Live Fences: In the drier zones of the project area (400mm-500mm), wind erosion is becoming an increasingly important phenomenon. Wind erosion does not produce the spectacular results of water erosion/channel flow. Its effects are less obvious but may be equally or more damaging as the fine dust is removed from the soil. Windbreaks could have an important role to play in agriculture in these areas. On-farm research in the Majjia Valley in Niger has shown that a single line of Azadirachta indica (neem) can increase millet yields up to 30% while providing a substantial source of on-farm income through the sale of poles and firewood. This research has also shown that windbreaks significantly reduce plant stress at the critical time of sowing/germination and that survival of young millet plants is significantly increased due to reduced damage from moving sand.

(4) The role of windbreaks in protecting crops against desiccating winds and stabilizing soils in the NCPB has been accorded little attention in the past. Some windbreak species/configuration trials have been conducted but the trials were not associated with a crop component and their effect on agricultural yields and soil stabilization is not known. Any future research program should associate a crop component and pay particular attention to labor cost and availability issues. In order for windbreaks to have and impact, a wider than farm scale (e.g., community level) approaches are needed.

(5) Boundary plantings, (field perimeter plantings, live fences and hedges) have the potential of reducing wind erosion and evapo-transpiration and increasing crop yields at the field/micro level. They have more potential than windbreaks for adding organic matter and nutrients to the soil. They can also provide secondary benefits of fuelwood, fodder and fruit. Boundary plantings are one of the simplest methods of incorporating trees/shrubs into farming systems with minimal tree-crop competition and an added potential for the production of a number of tree products. Trees can be managed by lopping, pollarding, coppicing or felling.

(6) Single line living fences of Euphorbia balsamifera and occasionally E. tirucalli played a significant role in farming systems, both in terms of protecting crops from blowing sands/desiccating winds and as a means of controlling livestock. By intercepting and stabilizing drift sand, the microclimates established in their lee side are conducive to the regeneration of native plant species. With the advent of animal traction, many of these fences were destroyed to facilitate plowing. ISRA has already conducted considerable research on live fences (species, spacing, combinations, etc.) but the economics of these fences have yet to be considered. Major constraints to farmer in re-establishing live fences are labor and seedling availability.

(7) Natural Forest Management ("khours" and field tree mosaics): Recent research indicates that there are now villages/farmers who, (on their own), are taking measures to protect their environment. One of these measures is protecting (mise en défense) "khours" areas (bas fonds or depressions). These areas have cracking clay soils and are difficult to farm. In the past, they have served as a pasture/range resource for livestock as a result they are usually severely degraded. As livestock holdings have decreased for many farmers because of the drought, vegetable gardening in the khours has become increasingly important where the water table is relatively close to the surface. Where the water table is deeper, some villages are now protecting these areas in order to enhance natural regeneration. These areas have potential to provide increased forage, fuelwood and service wood supplies and relieve pressures of trees on-farm. Lack of knowledge on natural forest management techniques and sustained and rational use of these areas, should be an area for ISRA research.

Due to Senegal's structural adjustment program and the removal of fertilizer subsidies, many farmers are returning to traditional methods of incorporating organic matter and nutrients into the soil. There is renewed interest among farmers in re-establishing the A. albida agroforestry system and using other indigenous trees and shrubs to improve soil fertility. However, with the exception of

cad, information on traditional species and techniques is lacking and the development of a field tree mosaic (parc a bois, amenagement de l'espace) research program would appear to be another area for ISRA research.

(8) Indigenous fruit trees: As peanut production is declining in the farmers are seeking alterative methods to generate on-farm income. One of these methods is the increased sale of fruit and other food products from a wide variety of indigenous tree species. Balanites aegyltiaca (for oil) and Ziziphus mauritiana (for fruit) are particularly important sources of income for many farmers. ISRA is already considering a genetic improvement program for certain indigenous fruit trees which will more than likely be funded by FAC. The project could assist ISRA in bringing outside germ plasm for the program, particularly the small seed variety of Ziziphus spp. developed in India.

(9) Water Harvesting Techniques/Microcatchments: Microcatchments are systems of small V or U shaped bunds (15-20 m wide at the top) arranged across fields following the contours and spaced according to slope. They are used to channel runoff, either to a single point at the bottom of the V or U or occasionally along a contoured land surface to cultivated or storage areas. Research on this technique by OXFAM and others in Burkina Faso indicates that microcatchments can effectively increase the rainy season by one to two months with the water retained at the bottom of the structure. The results were substantial increases in crop yields, up to 100% in the case of millet in some areas. The technique is somewhat less labor intensive than tied ridges but labor constraints in some areas preclude its use. Ridging does not work well on sandy soils as the ridges tend to disintegrate in heavy rains.

B. South-central Peanut Basin

Cordyla pinnata study: Cordyla pinnata in the South-Central Peanut Basin functions much the same as A. albida does in the north. However, information on the system (i.e., contributions to soil fertility, fuel, food, forage, etc,) is lacking as is information on how to enhance the system. A special study on the species similar the ones done on A. albida could be researched by ISRA.

Live fences: ISRA has already begun an on-station and on-farm live fence program in the region (species, configuration and management techniques) this study merits continued support. More emphasis needs to be placed on the economic aspects of the technology as labor and seedling availability appear to be constraints in adoption of the technology.

Senegal Oriental and Haute Casamance

Acidification: Many of the soils used for wooded fallow tend to be acid because parent materials are acidic and cation exchange capacities are low, due to lack of vegetation and low organic matter content. Consequently, basic cations are leached from the crop rooting zone and not recycled by deeper rooted plants such as trees. The replacement of basic cations with hydrogen results in a decline in pH. Additional research on liming and/or on-farm field trees (field tree mosaics, alley cropping, etc,) appears warranted. Of particular interest might be the increased use of Sterculia setigera, a gum producing species, as an on-farm tree. The emphasis should be placed on the use of locally available resources to correct the problem and not on the use of external inputs.

Agroforestry Diagnosis and Design: In collaboration with ICRAF's African Research Network for Agroforestry (AFRENA), ISRA has already conducted a macro-diagnostic and design exercise for much of Senegal and a micro diagnosis and design for the Peanut Basin. Using interdisciplinary teams (agronomy, soil science, water management, animal science, forestry, economics and sociology), the purpose of these micro studies is to identify land use constraints, their causes and potential for removal or for new production patterns which make better use of available resources to meet the objectives of a target group of farmers in a particular agro-ecological zone. These, together with considerations of sustainability and adaptability, will lead to the formulation of design specifications for appropriate technological interventions in the farming system. ISRA is planning to conduct similar studies for Senegal Oriental. Project support for this effort appears to be warranted.

D. Southwest Casamance

Swamp rice production is of growing concern in the Casamance, where increased siltation and salinization of rice paddies are primarily the result of loss of vegetative cover. Periodic and prolonged drought in the Casamance have driven many farmers to migrate to the plateau areas. The result of expanding agriculture on the plateau is a forest cover which is severely depleted. The clearing of the vegetation has resulted in increased downstream soil erosion and rice field siltation. Also a reduction in the fresh water underflow down to the lower valleys and an alteration of the salt and fresh water interface. The net result has been continuing encroachment of salt water into areas not protected by dikes or intrusion dams.

Swamp rice production in the Casamance depends on annual flushing of salt from soils where the sea has intruded. If rainfall is insufficient the process will be inadequately affected and rice production correspondingly reduced. Because of the current dry cycle, the flow of fresh water through rice producing areas has been reduced. The ability to control the flow of fresh water from and the flow of saltwater to these soils is an improvement over

depending on rainfall and runoff for the same purpose. Given this capability, traditional knowledge of soil management practices can be used to boost yields and achieve significant returns in a relatively short time. In the process vulnerable soil resources are saved from severe salinization and acidification.

Farmers have traditionally used salt-dams to enhance swamp rice production. Low rainfall conditions which have prevailed over the past two decades have in many cases made traditional methods of water control inadequate. A potential danger of anti-salt dams is that soil which is vulnerable to acidification may be allowed to dry and oxidize. The result is severe acidification which occurs immediately when the soils are dry. Desalinization of soils can cause unprotected clay soils with a low pH and lack of P205 the result is a strong liberation of aluminum which causes aluminum, then iron toxicity and finally even a lower P205 content.

ISRA has been conducting research on the salinization problems for sometime. A series of measurements are available which give salinity profiles and discharges through control works and water table elevations. All this data is used to determine desalination rates. Other initiatives which started by the group include: (i) research on the use of a sluice gate as opposed to a weir on the dams; and (ii) diluting the salinity of the soils by flushing with seawater in the dry season and by fresh water in the rainy season. These activities merit continued/expanded support particularly if combined with a stronger watershed management program.

Use of natural fertilizers for swamp rice production: ISRA researchers, in collaboration with WARDA, are conducting research on the use of natural fertilizers such as the bacteria Azolla spp. and the shrub Sesbania spp. These species have the ability to add important quantities of nitrogen to the system. Preliminary results indicate that commercial fertilizer needs can be significantly reduced by using these species, but additional on-farm testing is required.

Micro Diagnostic and Design Exercise: As in the case of Senegal Oriental, ISRA, in collaboration with ICRAF wishes to conduct a micro D&D exercise in the Casamance project resources could be used to support this study.

ISRA's Institutional Capacity

by Jane Ellis

ISRA is one of the strongest national agricultural research institutions in West Africa with considerable infrastructure, a lengthy history of research, and a well-trained staff, which has produced research with impact. While recognizing ISRA's strengths, it is also an institution suffering from serious organizational, programming and financial management weaknesses. Acknowledging its institutional problems, ISRA, under strong leadership from its director general, developed a plan of institutional reform that seeks to address and redress its institutional constraints. However, arriving at a streamlined, efficient, effective ISRA will not be easy. ISRA is faced with a plethora of difficult choices with competing priorities and in an atmosphere of enormous pressure from the GOS and donors to get its act together once and for all. No one project or donor can 'fix' ISRA. However, given the commitment and leadership of ISRA's current management, the NRBR project will work with ISRA to build upon the solid institutional foundation ISRA has laid and from which ISRA can contribute effectively to agricultural production in Senegal.

In order to determine ISRA's institutional viability and capabilities, its strengths and weaknesses, this analysis will examine ISRA's current status, organization, research program, human and infrastructural resources; and will identify institutional constraints/issues and opportunities for project assistance.

Historical overview

ISRA has considerable history. Agricultural research was launched in Senegal by the French colonial service in the 1920s. Initially a research station was established at Bambey to develop improved varieties of peanuts and associated cultural practices. Research on food crops (millet, sorghum, cowpeas) grown in association with peanuts was introduced in the 1930s. Livestock research was also introduced during this period with the establishment of a veterinary laboratory and later expanded in the 1960s with assistance from the French "Institut d'Elévage et de Médécine Vétérinaire des Pays Tropicaux" (IEMVT). Research continued to be directed and carried out by French scientists until 1974 when ISRA was established as the national agricultural research institute. ISRA is mandated to serve the entire primary sector (crops, livestock, forestry, fishing). ISRA's basic mandate is to conduct adaptive agricultural research on production, resource management, and on-farm post-harvest problems.

From 1974 until the mid-1980s, ISRA grew in size of workforce (to approximately 1,500 employees), research program (10 departments), and infrastructure. However, starting in the mid-1980s, ISRA came under increasing donor pressure to correct institutional problems that distorted research priorities, manpower management, internal organization, and relationship to beneficiaries. While ISRA did enact measures to realign staffing and research priorities, the first round of reforms (in 1986-87)

did not go far enough and a further restructuring -- this time led by ISRA and the GOS -- was necessary.

In 1990 ISRA under new management, formulated a broad, ambitious set of reforms covering research programs, organizational structure, management, finances and personnel. This differed from the mid-'80s experience when the donors, under the leadership of the World Bank, recommended reorganization, a big staff reduction and management reforms. Results, then, were disappointing. This time, ISRA leadership has taken the lead, establishing a participatory process involving institute-wide representation in the form of working committees charged with both diagnosis of problems and identification of reform options. A dialogue was established with key ministries, the Presidency and donors. A regional conference was also organized with participation from various representatives of other African national systems, ISNAR, International Research Centers, donors, and a domestic constituency representing extension, finance and development policy. All of this was undertaken to generate options for reform and build understanding for both the need and the process of reform. ISRA management has presented its reform plan to its Board of Directors (Conseil d'Administration) for approval. As a result, ISRA further reduced its personnel and currently has a staff of 558 people (115 researchers), organized into five research departments. This second restructuring, to be complete by the end of 1992, seeks to encourage integration of disciplines, facilitate collaborative research, and move towards a more professional management system.

Organizational Structure and Management

ISRA's new organizational decree, signed by President Abdou Diouf in January 1991, codifies ISRA's organization, functions and duties. ISRA is a public establishment of industrial and commercial character with a scientific vocation, and, within the GOS, is located administratively under the Ministry of Rural Development and Hydraulics. ISRA is governed by a board of directors and has two advisory boards. The board of directors meets at least three times per year and is comprised of nine members (one each from the Présidence, the National Assembly, the Ministries of Economy and Finance, Rural Development and Hydraulics, National Education, Animal Resources, and Industry and Arts, plus two members named at large for their professional competence). The Direction Committee (Comité de Direction) meets at least three times per year and follows the execution of the budget and research program and is comprised of representatives from Ministères de tutelle and three other members named by the board of directors. The Scientific and Technical Committee is an external advisory board that meets once a year and provides guidance to ISRA on its research program in order to assure scientific integrity and credibility. Members of the Scientific and Technical Committee are scientists (Senegalese and other nationalities) nominated by the ISRA Director General and confirmed by the Board of Directors.

Since 1980, ISRA's research departments have changed in number (reduced from 10 to 5) and organization. Until 1985, research program directors were simply advisors and research

station directors had the major role in budget control and execution of research programs. In 1985, center directors were placed under the research directors, which streamlined management in some departments, but created cumbersome and confusing dual management in others, notably the crops and systems department. Added to dual management were personnel conflicts where older experienced center directors were placed under the supervision of younger and relatively inexperienced research directors. As part of the 1990 reform plan and to alleviate dual management, research directors were named the center directors for the five major research centers. The new locations of research departments and their program directors are as follows:

- Crop Production at Bambey (primary research center) with secondary stations at Djibelor, Kaolack, Nioro, and Tambacounda;

- Production Systems/Applied Economics at St. Louis (primary research center) with secondary stations at Fanaye, Guede, and NDiol;

- Forestry Research at Dakar-Hann with administrative responsibility for the horticultural research center at Camberene;

- Fisheries Research at CRODT-Thiaroye; and

- Animal Production and Health Research at the national laboratory for veterinary research (LNERV) at Dakar-Hann with secondary stations at Dahra and Kolda.

Research directors are named by the Director General and confirmed by the Board of Directors. A research leader oversees the day-to-day administration at the secondary stations, relying on the major research center for overall responsiblity for the scientific and administrative matters. Research leaders are elected for three year renewable terms by their collegues at the secondary station.

Based on recommendations from the February 1991 Scientific and Technical Committee meeting, ISRA has proposed further changes in the scientific and administrative organization of its research departments. In a effort to streamline research programs and reduce infrastructure the Scientific and Technical Committee proposed that:

- the research center at Bambey become the Rainfed Crops Production Research Dept.;

- the research center at St. Louis become the Irrigated Crops Production Research Dept.;

- the research programs from the former Systems/Applied Economics Dept. be divided among the rainfed and irrigated crops depts.; and

- the production economists be assigned to the crop production departments and that the macroeconomics research

program be attached administratively to the Direction General as a 'bureau d'études'.

The Scientific and Technical Committee made the following recommendations concerning research facilities:

- that the station at Tambacounda be closed and cotton research transferred to Kolda;
- that the Kaolack research station be closed and personnel and programs be transferred to Bambey;
- that all researchers at Nioro be transferred to Bambey, leaving a technician to manage the secondary facility;
- that the forestry research station at Djibélor be closed to regroup the forestry research program within the agronomic research station at Djibélor; and
- that the Dahra research station be kept to conduct on-farm animal, forestry and NRM research.

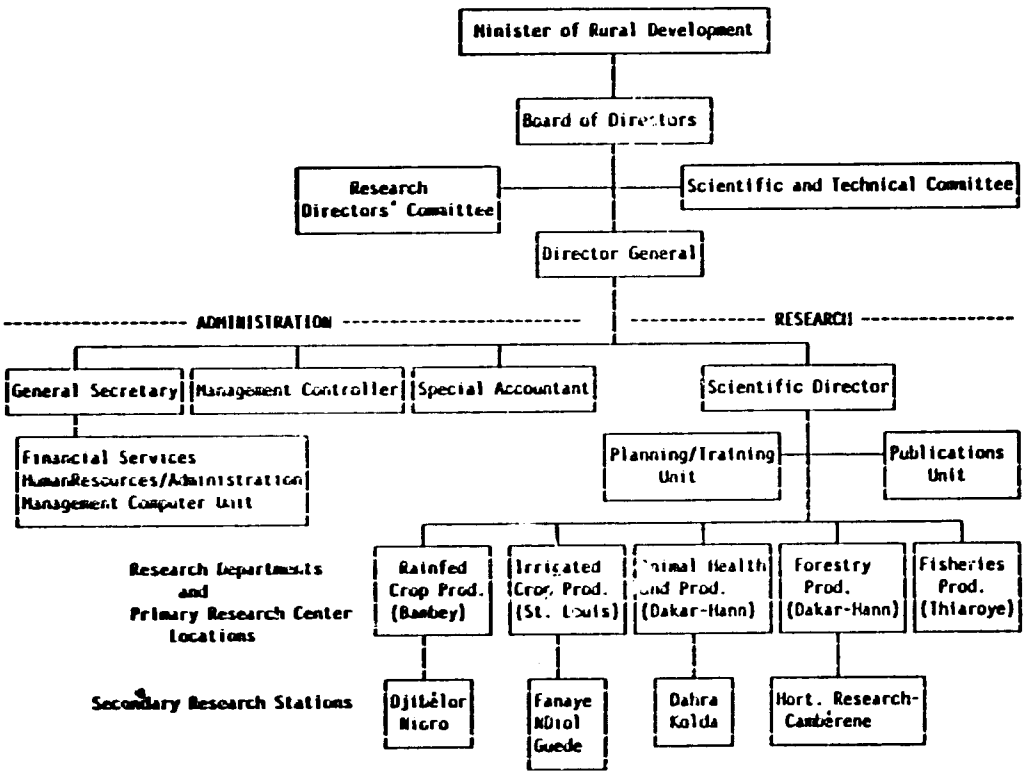
These changes will be presented to the Board of Directors meeting at the end of May 1991 for approval. While it is uncertain at present if some or all of the Scientific and Technical Committee recommendations will be implemented, their recommendations do underline the lack of long-term institutional planning at ISRA as well as the vagaries of donor support. For example, the research station at Kaolack was constructed in the mid-1980s as part of the World Bank's first agricultural research project, and now, less that five years old, the Kaolack station is to be closed. The Bambey research station, while once the flagship research station for French West Africa, has had minimal funds spent on upkeep over the past 15 years and the facilities at Bambey bear witness to this fact.

ISRA has changed its organizational chart and lines of authority twice during the 1980s. The current organizational chart removes the constraint of dual lines of management and authority, and decentralizes some functions, while creating other constraints that hamper the day-to-day management of the research programs. ISRA's administrative and financial management have been hampered by lack of control on finances and inventory, justifying the need for tighter monitoring of resources. Secondary stations, once totally independent, must send all financial statements to the primary research centers for processing and reimbursement. The administrative burden at the primary research centers has increased dramatically, but because administrative and accounting personnel at the primary centers have not been increased accordingly, the processing of financial statements from the secondary centers can take months. Thus, research programs with money available are slowed due to lack of access to necessary funds.

Figure 1 presents ISRA's newly revised organizational structure, including research stations.

Figure 1

ISRA Organizational Chart[1]
(Proposed)



[1]This organizational chart was presented to the ISRA Board of Directors in May 1991 for approval. The procedures for closing research centers and stations (Kaolack, Tambacounda, e.g.) and transferring personnel have not been worked out as yet.

190

Infrastructure

ISRA has an extensive network of research centers and stations, plus various relatively unimproved sites where trials and demonstrations are carried out. This is an asset in terms of the broad range of ISRA's research mandate (crops, livestock, forestry, fisheries) and the great diversity in agroecological production zones, but recurrent costs of operation and management requirements are high. Recurrent costs associated with operation and amortization increased five fold between 1982 and 1987 due to rapid expansion of infrastructure financed by the World Bank.

Recently, ISRA management has taken measures to curtail utility costs. The reforms which ISRA presented to its Board of Directors proposed to consolidate management by transferring two research directorships (crops and agrarian systems) to research stations, thus reducing and simplifying the management structure. Station management itself is frequently weak. Increasingly, young, well-trained researchers are assigned to station directorships with little prior research management experience. At lower levels, there has been no training in station management skills. In sum, ISRA's physical infrastructure is an important asset but management reforms are necessary to curtail costs, improve management and possibly utilize excess capacity to generate revenue to defray the costs of the stations.

Research Program and Management

One of the cornerstones of ISRA's reform plan is the move towards a core research program or 'noyau dur', capable of responding to the country's highest priorities, fully funded by the GOS and carried out by ISRA's best research staff. This core program would be insulated from the rise and fall of donor support. However, until the core program is identified, the strategic planning document for ISRA is its five-year plan which sets forth research priorities and programs over the period, 1989-1993[2]. This plan defines 32 regional research programs covering eight agro-ecological zones and involves crops, livestock, forestry, fisheries, farming systems and natural resource management research. These are complemented by 13 national programs.[3]

While the plan has much merit in its effort to deal with national development priorities and set research priorities, it is far too ambitious and comprehensive for a struggling national agricultural research institute. Only one donor, the World Bank, accepted the plan as a strategic planning document and, with some modification, as a basis for project assistance. However, the five-year plan has not been operationalized as of early 1991

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[2]Stratégies et Programmation des Recherches, 1989-1993, Présentation en Synthèse.

[3]ISRA planning documents that deal with program reorganization say there are 62 research programs, not 45 specified in the final version of ISRA's Five-Year Plan.

because the World Bank's Second Agricultural Research Project has not started disbursements, thus severely curtailing financing available for research programs contained in the five-year plan. Also in 1990, ISRA was overtaken by financial crisis and domestic political pressure for institutional reform to align ISRA's research program and personnel with available financial resources (both from the Government of Senegal and donors).

As part of ISRA's reform plan, a drastic reduction in the number of research programs has taken place (from 62[4] to 30) with much of the consolidation affecting the departments of crops and agrarian research as shown in Table 1.

Table 1

Proposed Research Program Reduction

Department	Number of Research Programs	
	Former	Revised
Crops	15	5
Agrarian Systems	16	4
Forestry	12	5
Animal Science	9	6
Fisheries	10	10
TOTAL	62	30

This consolidation may improve research management but any financial savings are likely to be modest. This consolidation is intended to increase scientific collaboration, assemble a critical mass of scientific expertise and consequently make more efficient use of scientific, physical and financial resources while improving research methodology through both increased interdisciplinary collaboration and peer review. Research programs are ISRA's basic unit of research management. Thirty research "units" in an institute of 100 plus researchers seems a more manageable and potentially more effective organization of resources. This reform is to be achieved by regrouping small programs into larger ones and not through the elimination of research programs. Consequently, research activities and financial requirements are unlikely to diminish very much.

An important but difficult issue concerns research priorities. ISRA's Five-Year Plan serves as formal statement of priorities, weighted by the size of resources budgeted. Even though budgeted and actual expenditures have borne little relationship to each other in the past, the five-year plan at least provides ISRA's idealized view of priorities, undisturbed by the financial crisis.

If actual or potential contribution to the economy as measured by share of GDP is the criterion for setting research priorities, then even a casual perusal of the five-year plan's priorities raises some interesting questions. The allocation of

[4]World Bank, Staff Appraisal Report, Senegal, Second Agricultural Research Project, February 26, 1990, p. 13.

resources between the eight agroecological zones is surprisingly homogeneous - 5% to 7% of the total budget in seven out of eight cases, even though the regions vary greatly in actual and potential importance of production. Similarly, commodity priorities seem askew. Recognizing that support for commodities may be hidden under other rubrics such as "farming systems", "resource management", etc., nevertheless it is striking to note that only 3% of the direct costs of the national research program budget is allocated to peanuts and 8% to coarse grains (exclusive of paddy production) whereas each accounts for about 45% of the share of total crop production and peanuts generate 17% of total export earnings and 80% all agricultural exports. Uma Lele, World Bank, comes to similar conclusions in her analysis of implicit research priorities evidenced by budget allocation patterns during the early to mid-80's when the first World Bank agricultural project was financed. Thus, there is a good case for reevaluating research priorities; first, because financial crisis is forcing even further retrenchment and reorganization (more of this below in the financial analysis section) making obsolete ISRA's five-year plan, and second, because priorities, neither formal nor defacto, are consistent with development reality, farmer constraints or market forces.

The question of research priority setting and research program planning is an interesting one. Different levels of research planning and priority setting exist, but lacking is operational research planning, management and coordination for the institute as a whole. While the five-year plan presents ISRA's idealized view of priorities and research programs, the annual research program planning exercise is much more practical as secure funds are matched to proposed research programs. ISRA's annual planning process starts with the budget process in September/October. Researchers prepare research program outlines and detailed budgets. The programs and budgets are reviewed by the research director and research program coordinators before submission to the secretary general (budget review) and scientific director (research program review).

Individual donors may meet with the ISRA researchers or program coordinators of the specific donor-financed programs to review the previous year's research and to plan the following year. Once the World Bank's project becomes operational, the World Bank will approve research programs it finances on an annual basis.

On a regional level, ISRA participates in planning sessions, organized by the World Bank-financed agricultural extension project (PNVA) to strengthen research-extension linkages. Participants in these regional meetings include representative from the regional development authorities, the extension services (agriculture and livestock), NGOs, and farmer groups. The regional meetings are held before and after the agricultural season, the former to plan the activities for the rainy season and the latter to review the outcome. The choice of which research programs to execute is based upon a balance between the established GOS development priorities for the region, the constraints identified by the participants of the regional planning meetings, and the amount of funds available to execute the research programs. Problems that have arisen in the regional

planning sessions include lack of farmer participation in setting the research agenda (the 'training and visit' extension system upon which PNVA is based is very top-down) and lack of funds to execute the chosen research programs. Under PNVA, funds to finance research programs chosen at the regional planning meetings are to be covered by GOS counterpart funds (not directly by the project financing). The lack of the GOS counterpart funds has constrained the execution of the research-extension programs under PNVA.

On a national level, a consultative commission on agricultural research meets once per year to set national and regional priorities and to coordinate the research activities between ISRA and the University of Dakar where potential for overlap exists. The consultative commission is organized under the Direction of Scientific and Technical Affairs (DAST) within the Ministry of National Education in coordination with the Ministry of Rural Development and Hydraulics. Members of the consultative commission are representatives of GOS ministries, the Presidency, regional development authorities, the agriculture and livestock services, the agricultural training schools, donor projects as well as ISRA and the University of Dakar. The January 1991 meeting of the consultative commission identified institutional constraints and outlined broad research priorities for each of the ISRA research departments. Four major institutional constraints were identified:

1. Lack of measurable impact of research programs caused by a) lack of farmer input in the definition and execution of research programs; b) absence of research-extension collaboration; and c) absence of consideration of sociological questions/aspects in most research programs.

2. Financial constraints including ISRA's difficulty in mobilizing GOS funding for research programs, and the lack of coordination of donor financing which causes administrative problems for ISRA.

3. Human resource constraints that have frozen hiring of personnel even for replacements and underline the difficulty ISRA has in attracting and keeping qualified scientific and administrative personnel.

4. Absence of a 'statut de chercheur' that would attract and help retain qualified researchers.

The research priorities and programs listed are vast and far-removed from ISRA's institutional and human capacities to execute. On the one hand, the consultative commission encourages interdisciplinary research based on farm-level constraints, while the list of research program priorities are research department specific with no indication of how or which programs are to be interdisciplinary.

Once ISRA's research programs are decided upon, the research program as a whole is presented to the Scientific and Technical Committee (CST) for review. The role of the CST is not to set ISRA's priorities or define its research program, but rather to

evaluate its scientific basis/validity and make recommendations to the Board of Directors and the Director General. However, the CST that met in February 1991 was asked to define research priorities, using as guides the ISRA reform plan, the report of the consultative commission on agricultural research, and the outlines of the research programs with secure funding. While uncomfortable in the role of priority setters, following consultations with research directors, the CST did list research program priorities to be reviewed by ISRA and its Board of Directors. The following are the research priorities recommended by the 1991 CST:

Crop production research:
- Priority 1 - Irrigated maize
- Priority 2 - Vegetable production
- Priority 3 - Rice
- Priority 4 - Millet and sorghum
- Priority 5 - Peanuts
- Priority 6 - Grain storage

Production systems research:
- Priority 1 - Production systems research (River Basin, Peanut Basin, Lower Casamance)
- Priority 2 - 'Etudes de milieu'
- Priority 3 - Production factors (mechanization, water use and hydrology, post-harvest technology)
- Priority 4 - Economic studies

Forestry research:
- Priority 1 - Conservation and improvement of the ecosystem
  - Subpriorities-
    a. Varietal improvement
    b. Agroforestry
    c. Biotechnology
    d. Livestock/NRM relationship
- Priority 2 - Energy self-sufficiency
  - Subpriorities-
    a. Study of irrigated tree plantations
    b. Study of natural forests and their management

Animal health and production research:
- Priority 1 - Improvement of meat and milk (beef, goat, sheep)
- Priority 2 - Research on the relationship between animals and NRM, especially natural pastures, and how to improve this relationship, including socio-economic studies
  - Subpriorities-
    a. Reproductive physiology
    b. Animal health, with emphasis on PPR ('Peste des petits ruminants)

Fisheries and oceanographic research:
- Priority 1 - Optimization of fishery resources
  - Subpriorities-
    a. Biology and ecology of the species
    b. Resource evaluation
    c. Rational exportation of the stock
    d. Socioeconomics of fishing

The CST also recommended the dissolution of the Production Systems/Applied Economics Research Dept. and the reallocation of research programs into irrigated and rainfed crop production research programs as follows:

Irrigated crop production research programs based in St. Louis

- Maize (all corn research including rainfed)
- Rice (all rice research including rainfed and Casamance systems)
- Vegetable production
- Hydraulics - Fleuve
- Mechanization - Fleuve
- Production Systems - Fleuve
- Soil fertility and conservation
- Salination (anti-salt dams/recovery of saline fields)

Rainfed crop production research based in Bambey

- Millet
- Sorghum
- Peanuts
- Cowpeas
- Cotton
- Applied microbiology
- Production systems (Casamance and Sine-Saloum)
- Valorization of natural resources
- Production of foundation seed
- Soil conservation and fertility restoration
- Post-harvest technology

The priorities outlined by the CST reflect the preoccupations of current French assistance to ISRA, the legacy of ISRA's French colonial heritage of compartmentalized research, as well as the interests of the CST members. While integrating the production systems research program into the crops department, the CST recommendations reinforce research along departmental lines, instead of promoting interdisciplinary research. For example, current French assistance to ISRA through CORAF has established three base centers for varietal and agronomic research on irrigated maize (St. Louis), vegetable production (Camberene), and peanuts (Bambey), the majority of the research taking place on-station. It is not surprising that these commodities are among the highest priorities for the CST given the considerable financial and human resources CIRAD and IRAT are investing through CORAF. The composition of the CST is supposed to be multinational and interdisciplinary. The members present at the 1991 meeting were Frerch (4) and Senegalese (4) with the notable absence of the American scientists. The absence of the American scientists was important when the CST discussed the role that farmers or other beneficiary groups should have in setting the research agenda and evaluating the results. Several members felt that ISRA scientists should not be working with farmers because working with farmers is the job of the extension services. Others felt that ISRA scientists have been isolated from the realities of Senegalese farmers long enough, and that most research needs to be carried out with cooperating farmers,

not on-station or under the controlled setting of PAPEMs ("point d'appui pour les essais multilocaux").[5]

Finally, there is the matter of the quality, performance, and impact of research programs, particularly in areas most closely related to USAID's strategic interests. This is important because it defines the basis for future research efforts. Critiques of ISRA's research program which are of greatest relevance in this context include: 1) commodity research programs are inordinately oriented toward plant breeding; 2) food crop research concentrates excessively on improved varieties and purchased inputs rather than on low-cost technologies that would improve upon traditional cultivation practices; 3) crop-specific and farming systems research programs are not sufficiently coordinated, resulting in crop-specific research that does not address farm-level constraints identified by farming systems research; 4) farmers and extension agents do not participate sufficiently in setting specific research program priorities; and 5) livestock research findings are not adequately integrated into livestock and crop production systems research.

Notwithstanding the legitimacy of these critiques, the development of farming systems research has significantly reduced these problems over the last decade. Farming systems research has improved the definition of research problems and improved knowledge of where technologies may be applicable thanks to careful definition of homogenous production zones. It has also introduced an interdisciplinary, on-farm research methodology that is now accepted and it has produced research programs of greater relevance to farmers. Credible production systems research and institutional capability has been developed in the Casamance with USAID support. The range of technologies from soil preparation and improved varieties, to improved planting, weeding, fertilizing, and rotations have been developed for rice and corn production systems that produce significant yield increases and provide handsome economic returns. The two other production systems teams (Senegal River Basin and Sine Saloum) have suffered from lack of manpower (especially, the ability to retain social scientists) and from the inability to move from constraint diagnosis to demand-driven on-farm research. The applied economics research program has generated highly useful results, producing policy-relevant analysis based on empirical field research rather than recycled secondary data. However, the applied economics program has not been integrated into ISRA's commodity research program and therefore, has been slow to evaluate technologies or packages that have been proposed by the agronomists, foresters or animal scientists.

When ISRA lists its accomplishments and research results, the inevitable is a long list of crop varieties, technical recommendations, and titles of studies completed without reference to the impact of this research that should answer fundamental questions about why the research was conducted and

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[5]The American members of the CST tend to be very practical, results-oriented scientists who place farmer concerns above researcher interests, and for this reason their input was missed at the 1991 CST meeting.

what the results were in quantifiable terms. For example, ISRA has produced millet and sorghum varieties that are drought resistant and better adapted to the shorter growing seasons characteristic of the last 20 years and has developed a technical package including an improved, short cycle drought resistant variety of cowpeas. While not underestimating the importance of these varieties or technical packages that ISRA has developed, there has been no impact assessment of the ISRA varieties on-farm or their adoption (or potential for adoption) by farmers. ISRA would argue that breeding and varietal screening should continue, even though most experts agree that the most important gains in the future are likely to come from improved agronomic practices not from improved varieties. ISRA lacks a system for research evaluation and accountability that would quantify impact of research results as well as justify further investments in agricultural research.

Research management is another area where weaknesses exist, and an area that cuts across the whole of the institute, which is understandable given the lack of a well-defined strategic plan and the lack of priorities defined with farmers targeting farm-level constraints. Issues related to research management include:

1. Research Priorities - In launching its reform initiative guided by the goal of creating a "noyau dur" (core program), ISRA has acknowledged the need to rethink its program in strategic terms, organizing resources around priorities which are financially feasible to support. Its research program consolidation, reorganization and deployment of research staff and financial retrenchment all require rethinking ISRA'strategic plan and research priorities.[6]

2. Rationalization of the structure of ISRA to clarify roles, reduce redundancy and improve management. The dual management structure of research department directors and station directors has caused considerable ambiguity about authority and responsibilities while increasing the bureaucratic hierarchy and slowing management decisions. ISRA has tackled this issue by naming research directors as station directors and moving two directorships out of Dakar. Research stations have been reassigned to different research departments, in order to reduce management burdens.

3. Research directors' roles are proposed to be exclusively scientific; they are to provide intellectual leadership in helping to formulate and evaluate research programs, advise on manuscripts and reports for publication. Administration (financial, personnel, etc) is to be handled by station directors dealing with central administration in Dakar operating under the purview of the Secretary General.

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[6] ISRA acknowledged that "established plans" will need to be revised since they do not coincide with the realities that are necessitating ISRA's self proposed reforms. ISRA, Plan de Restructuration de l'ISRA, Jan. 1991.

4. Research planning and budgeting suffers because there is not a well defined system for submitting research proposals and budgets, and the administrative process is unduly long and cumbersome due to multiple layers of administration.

Human Resources

One of ISRA's primary assets is its workforce. Given the size of the country and economy, the role of agriculture and its contribution to the GDP, and the level of development, ISRA enjoys a scientific staff that is relatively well trained and ample in number. Effective use of these assets has been somewhat constrained by organizational and management problems. Salary costs of this staff represent a major financial burden relative to available resources.

As of April, 1991, ISRA employs a total of 558 Senegalese working in 12 research centers or stations (including the headquarters). This number does not include 50-plus expatriates, mostly French. Scientific research staff numbers 115 accounting for 21% of total staff; they are directly supported by a cadre of laboratory and field technicians representing another 39% of the workforce. Administration support staff and laborers make up the other 40% of the staff, a heavy burden relative to those directly engaged in research. ISRA employs a total of only 53 women, of whom 32 are secretaries. Seven women are researchers (6% of 115 total researchers); six are research assistants or high level technicians; and four are administrative or accounting professionals.

Scientific staff are dispersed over a wide range of disciplines, different centers and stations, plus various administrative, laboratory and research facilities in Dakar. Obviously this coverage - geographic, programmatic and disciplinary poses management problems in terms of administration, cohesion, critical mass, coordination and cooperation, etc.

Table 2 shows ISRA research personnel by discipline and degree and Table 3 summarizes the disciplines and educational level of ISRA's scientific staff and . While relatively well trained in terms of degree level, the top of the pyramid representing the scientific leadership is rather weak - only 4% of the staff with the equivalent of a PhD[7]

[7] ISNAR. 1990, Assessment of ISRA's Training Requirements (Draft).

Table 2

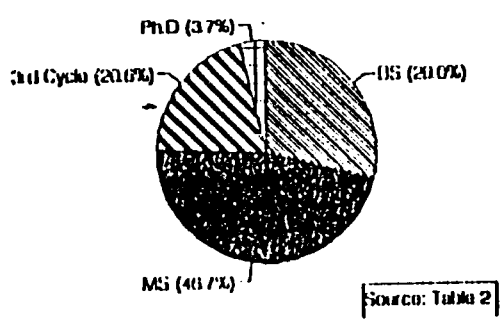
ISRA RESEARCH PERSONNEL BY DISCIPLINE AND DEGREE
(Source: ISRA, 1991)

	BS/DrVet Ing. Agr.	DEA MS	Dr. Ing. Dr. 3rd Cycle	Ph. D Dr. d'Etat	TOTAL
Agronomy	9	2	0	0	11
Soil Science/Physics/Microb.	1	3	6	1	11
Agronomy/Animal Science	1	0	0	0	1
Plant Physiology	0	1	2	0	3
Plant Pathology/Virology	2	1	1	0	4
Plant Genetics	1	2	2	1	6
Ag Engineering/Water Mgt	1	3	1	0	5
Weed Science	1	0	0	0	1
Entomology	3	2	3	0	8
Agricultural Economics	1	7	0	1	9
Sociology	0	1	0	1	2
Silviculture	1	5	0	0	6
Agroforestry	1	1	0	0	2
Fruit Trees	0	2	0	0	2
Statistics/Biometry	0	0	0	0	0
Bioclimatology	0	0	1	0	1
Animal Science	5	4	0	0	9
Pastoralism	1	1	0	0	2
Animal Nutrition	1	2	1	0	4
Animal Genetics	1	0	0	0	1
Animal Path./Virology/Microb	1	4	1	0	6
Environment (CRODT)	0	2	1	0	3
Biology (CRODT)	0	4	2	0	6
Oceanography (CRODT)	0	3	0	0	3
Chemical engineering (CRODT)	0	0	1	0	1
TOTAL	31	50	22	4	107

ISRA has 115 researchers total. Information not available for 8 researchers.

Figure 2

ISRA Research Staff by Education Level
(Percent of Total)



ISRA's staff is predominantly middle aged, over 80% between 30 and 49. This is largely a function of recruitment patterns. ISRA grew rapidly from 1973 to 1984, the period approximately coinciding with its creation and expansion as a Senegalese research institution. The average age of researchers ranges from 34 in the forestry department to 37 in the Crops Department. Recruitment has been stringently limited since 1987, due to budget limitations. Given recruitment constraints and the absence of young staff, this age structure poses some problems in the short run for retraining and restructuring scientific manpower to adjust to new priorities and in the long run for maintaining program and management continuity as this huge age cohort begins to retire.

Judgments about the quality of performance of staff is difficult given the lack of a personnel evaluation system. Advancement is based on seniority, limited to six levels. With AID financing under Senegal Agricultural Research II Project, ISNAR is in the process of helping ISRA to develop such an evaluation system that will greatly enhance management's ability to provide performance-based rewards, to discriminate in training and promotion decisions and to serve as a tool for selecting out non-productive employees. In the meantime, one must rely on the assessment of knowledgeable observers who say there are some very good researchers, there are those who are marginal but potentially productive, given appropriate training, and there are those who ISRA needs to release because they are unproductive. Eliminating those with little potential to contribute would give ISRA some flexibility to restructure its research staff to reflect research priorities which the ceiling on positions now prohibits.

Personnel Management. With ISNAR's help, ISRA is developing the tools required to establish a professional personnel evaluation system that will permit meritorious promotions, selection out and training decisions. A career ladder is also being developed which will afford upward mobility through various job ranks and which will open up a scientific track that allows senior personnel to advance as scientists rather than limiting senior promotions to management. In response to a morale problem, ISRA management asked for a review of its salary scale. ISNAR recommends a judicious set of salary adjustments (which are constrained for the moment by the budget). This is a potentially valuable tool in rewarding performance and improving morale. ISRA also requires a training system for identifying needs, specifying training plans and employing a variety of techniques (non-formal, long-term, "sandwich programs" which intersperse the components of a single training program with normal work schedules, etc.) to improve the efficiency of training programs. These matters bear directly on the efficiency with which ISRA utilizes its most value resource - its personnel.

Training plan. In 1989-1990 ISNAR conducted an initial training needs assessment of ISRA. ISNAR's training needs assessment recommended that ISRA institutionalize training planning by implementing an annual training needs assessment, a rolling five-year training plan, an annual plan for short courses, and an annual plan for degree programs, and by maintaining a training data base. ISNAR also recommended that

ISRA establish the position of training officer (which has been done). ISRA's training plan would include responses for staff attrition and steps for realigning disciplines for future research programs. ISNAR strongly recommended that ISRA conduct its own training needs assessment and establish its own training plan that responds to ISRA's priorities. ISNAR cited that ISRA's training needs often do not coincide with the numbers and disciplines of training programs donors are prepared to finance. Other differences cited with donors is the strong preference of some donors to finance master of science (MS) programs rather than bachelor of science (BS) or doctoral (PhD) degree programs, whereas the needs of ISRA, as a research institute, requires PhD-level training for researchers, as well as personnel trained at the BS and MS levels.

Individuals selected for training should be recruited internally, and their training programs should match institutional needs (attrition and realignment of research program priorities) as well as career development plans for the individual. ISNAR recommended that each year one or two researchers should be trained in MS or PhD programs; that three or four research assistants be trained in MS programs; and that three or four technicians be trained in undergraduate programs (BS).

In the period 1988-1992 ISRA planned to train five MS and 12 PhDs. The disciplines are shown below:

Discipline	Number	Percent
Agronomy	1	5.9
Animal Science	5	29.4
Economics	7	41.2
Forestry	2	11.8
Genetics	1	5.9
Sociology	1	5.9

ISNAR's training needs assessment showed seventeen top and high priority training needs that require short courses and six priority areas that require long-term training.

Priority Training Areas - Short and Long Term

Short-term
Discipline
Data collection/management
Occupational safety/health
Evolving technology
Organization of research
Technology transfer
Statistical/economic analysis
Overall objectives/implications
Animal vaccination
Equipment operation
Hydrologic evaluation
Administrative tasks
Budgeting/financial management
Communication/collaboration
Performance of subordinates
Decision making

Degree Programs
Statistical Design
Animal genetics
Biology
Statistics
Attrition-replacements

The major problems with long-term training programs cited by ISRA are the long absences from the institute and retention of trained staff upon return. ISNAR found the staff attrition rate at ISRA to be acceptable and well within the norms of a research institute its size. In the period 1984-88, researcher attrition rate averaged five per year (5.9%); of this average, four per year (4.4%) resigned. In 1981-1992, 28 researchers (24 MS, 2 PhD, 2 incomplete) participated in AID project-financed graduate degree programs. Eight of these participants (28.6%) have left ISRA. ISNAR postulates that training lower level staff for promotion within ISRA will lower staff attrition rates. To assess priority training needs due to attrition, ISNAR evaluated distribution of researchers and resignations by discipline as shown below.

Table 4

Researcher Disciplines (1989)

Agricultural Sciences	No.	% *	Nonag. Sciences	No.	% *
Agronomy	43	38.7	Biology	10	9.0
Animal/Vet. sciences	19	17.1	Ecology	8	7.2
Oceanography/Fish	4	3.6	Economics	6	5.0
Forestry	3	2.7	Sociology	3	2.7
Entomology	2	1.8	Physics	2	1.8
Soil science	2	1.8	Hydrology	2	1.8
Plant physiology	2	1.8	Biochemistry	1	0.9
			Biometry/Statis.	1	0.9
			Microbiology	1	0.9
			Chemistry	1	0.9
			Genetics	1	0.9
			Geography	1	0.9
			Computer Science	1	0.9
Total	75	67.5%		36	32.4%

* Percent of known agricultural and general scientists. (Total research staff = 120. 7 individuals are not listed in the ISNAR document.)

Table 5

Resignations by Discipline (1984-88)

Ag. Sciences	No.	% *	Index**	Nonag. Sciences	No.	%	Index
Agronomy	7	31.8	16	Sociology	4	18.2	133
Animal/Vet	3	13.6	16	Computer Science	2	9.1	200
Forestry	3	13.6	100	Chemistry	1	4.5	100
Oceanography	1	4.5	25	Economics	1	4.5	25
TOTAL	14	63.6%	0.18		8	36.4	0.22

* Percent of total resignations
** 1984-88 resignations/1989 staff in the discipline x 100

ISNAR's analysis shows that researchers, regardless of discipline, are equally likely to resign. However, indexes for specific disciplines show sensitive areas in both agricultural

and nonagricultural disciplines. The loss of scientists in forestry, sociology, computer science, and chemistry is critical to the institute. Since the ISNAR analysis, another forestry researcher has resigned, raising the index to 200; ISRA's only biometrician/statistician has taken a one year leave of absence and it is anticipated that he will resign; and the same is true for another agronomist and economist. To improve ISRA's capacity for rapid response to loss of key personnel, these disciplines should be targeted as priorities for long-term training.

A weakness in ISNAR's analysis of ISRA's training needs is the failure to evaluate which donors are financing training and how these scholarships are coordinated with ISRA and with other donors. With the advent of 'flexible' doctorate programs in France and Belgium, many ISRA researchers are opting for these programs because they require less time away from Senegal, their work and families. This reality may push ISRA to request BS or MS-level training from AID. Another issue not mentioned in the training assessment is the reinsertion of the trained researcher back into his/her research program upon completion of the degree program. Examples are numerous of trained researchers returning to find no funding and no program with which to work.

Subject to ISRA's verification and reevaluation with its own training needs assessment, ISNAR summarizes and recommends that each year approximately four ISRA staff members should enter graduate programs (MS or PhD) to maintain researchers levels and realign disciplines, and four staff member should begin undergraduate programs to strengthen ISRA for internal recruitment.

To date, ISRA has not developed its own training plan based in its own analysis of training needs. The lack of a training plan follows the lack of a medium or long-term strategic plan which sets the course for the institute.

Financing and Financial Management

A serious financial crisis lies at the heart of ISRA's institutional problems. This crisis has corroded financial management and planning since resources are allocated to pay the most pressing bills and to meet salaries rather than being allocated in accordance with budgets and formal research priorities. Research is compromised because field work and research supplies cannot be financed on a secure basis. Although domestic funding sources are relatively generous (between .87% and 1.2% of agricultural GDP from 1986-1988) they have been inadequate to meet salary costs and pay for the maintenance and amortization of infrastructure and equipment. Consequently, stations and facilities are deteriorating steadily. Meanwhile, ISRA has incurred huge overdrafts in excess of its authorized budget. Donors finance virtually all research program costs but do not pay salary costs and only a few donors (ORSTOM and CIRAD, e.g.) pay a percentage of indirect costs. This has two unfortunate consequences: 1) defacto, donors play a large role in setting research priorities by deciding which research programs get funded; and 2) ISRA has no flexibility to meet the

urgent needs of financing indirect costs - utilities, management, amortization of facilities and equipment - because only a few donors will finance such costs.

The most serious of all financial problems is the size of the wage bill relative to resources available from the national budget. (Donors do not finance employee salaries). In 1987, ISRA employed 1,474 people. During the first staff reduction, 406 employees were released which reduced the workforce by over 25% to 900-plus. This was to have been associated with a restructuring that would have reorganized research personnel, reduced staff at various research stations and realized major salary savings. This opportunity was squandered; salaries of lower level personnel retained were increased, sometimes nearly double the amount permitted by the federal salary scale, and efficiencies were not realized from the reorganization that followed. Consequently, a second draconian reduction in force was mandated and largely completed in June 1990. This reduction cut staffing levels from 885 to 558, a total of 327 positions representing 37% of the workforce. Most of these cuts are support staff. Research staff have been exempted and cuts of technical support staff minimized. ISRA estimates this reduction in force will save nearly CFA 350 million ($1.4 million) per year which is equivalent to 25% of the GOS's contribution to ISRA's in FY90. Research staff cuts will be made later when the decision can be based on systematic personnel evaluations. This awaits the implementation of reforms initiated with ISNAR's help. Painful and difficult as these cuts are, they are essential to ISRA's financial health and represent dramatic progress in its battle of the budget.

Nevertheless, salary costs will continue to absorb most of the GOS budget resources (the only available source of financing). Table 4 summarizes GOS short-term financing commitments to ISRA.

TABLE 6

GOS's Commitment to Finance ISRA's Budget

FISCAL YEAR	MILLIONS OF CFA		
	National Budget for Equipment	"Transfer" Budget	Total
1990/1991	500	913	1,413
1991/1992	536	940	1,476

Source: ISRA, Plan de Redressment de l'ISRA, January, 1991.

A cursory review of ISRA's available financing (Table 7) provide some interesting insights into the source and nature of ISRA's financing problems.

- The Government is by far the most important funding source providing double the amount of the next most important source, France.

- ISRA's 1991 Provisional Budget does not include the approximate 750 million cfa per year that ISRA will receive as part of the Second World Bank Agricultural

Research Project. In preparation of the 1991 Provisional Budget only secured sources of financing were noted. If the World Bank project starts by June 1991 when the ISRA budget is revised, the World Bank contribution to the overall ISRA budget will appear, raising the total ISRA budget to 3,483,937,000 cfa (approx. $11.6 million). The World Bank's funds will represent 21.5% of the overall budget.

- Government's funding at CFA 1.413 billion (about $5 million) is reasonable according to world standards, representing .9% of agricultural GDP[8]. The GOS agreed to finance ISRA at the level of 1.413 billion cfa for the budget year 1991. However, the 1991 budget year will be 18 months long as the GOS moves to a fiscal year that corresponds to the calendar year. ISRA must have the assurance from the GOS that the government's contribution will be adequate for the 18 month transition period.

- An appreciable portion (59.1%) of total resources comes from domestic sources when revenue ISRA is expected to generate is included.

TABLE 7

ISRA's 1991 Provisional Budget including Donor Support

SOURCE	CFA AMOUNT	PERCENT
GOS	1,413,000,000	51.7%
ISRA'S OWN RESOURCES	201,838,000	7.4%[9]
FRANCE	657,412,000	24.0%
CEE	304,538,000	11.1%
USAID	63,725,000	2.3%
CANADA	59,012,000	2.2%
VARIOUS SOURCES	34,412,000	1.3%
TOTAL	2,733,937,000	100.0%

[8]This percentage is calculated based on the average of agricultural sector gross domestic product for a two-year period (1988 and 1989) to reduce excessive variability.

[9]This amount is ISRA's estimation of its ability to generate its own resources. Traditionally, ISRA has been weak in accounting for these resources and making such resources available for other purposes.

Financial Management. As the financial crisis lies at the heart of ISRA's institutional problems, managing the scarce resources efficiently becomes more critical. The financial management system suffers from:

1. The lack of analytical skills[10]. Senior staff has been hard to retain at ISRA's salary level.

2. The computerized accounting system is powerful but not user-friendly and few people can use it. Many records are kept manually. The equipment defeats the system it was intended to support.

3. There is no system for indirect costs accounting. In the absence of definitions and data, there is no credible way to estimate these costs and consequently no way of billing for them or managing reserves to amortize and replace facilities.

4. The system does not generate information and tools for senior management to use in decision making.

5. Budgets are not respected in making expenditure decisions.

6. Accountability for use of funds is very weak, both slow and imprecise.

7. Existing research funds are sometimes 'frozen' and thus not available to researchers.

The implications of this analysis are that ISRA must find additional ways to cut costs and improve efficiency. More than research program consolidation may be necessary to reduce costs to available resource levels. Issues of research program size and priorities need to be revisited. Greater flexibility and discretion are needed in determining the things for which funding can be used. This includes the government's restrictions between personnel and "equipment" line items and donors' restrictions on financing indirect costs which are a significant and real part of total research program costs. And of course, financial management will have to be strengthened to insure whatever resources are available and priorities set, that the resources are allocated accordingly.

Though covering a wide range of management, organizational and financial issues, the basic idea of the reforms finds its expression in the concept of a "noyau dur", or solid core program. ISRA aspires to define a core research program representing the highest priorities of the State, supported with secure funding from the GOS budget and executed by ISRA's best research staff. The reform proposal ISRA has formulated and the issues it is struggling with are intended to advance this goal. This reform agenda will/must address various personnel, research and financial management issues.

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[10] ISRA has experienced financial personnel, but this personnel is not experienced in budget analysis.

Donor coordination

The foregoing discussion of ISRA's financial, research program and organizational management problems included donors as a source of funds as well as a part of the cause of ISRA's management burden. ISRA's donors are a blessing and a curse, each donor with specific requirements and interests, adding another management burden to ISRA. There has been no meeting of ISRA's donors since early 1988. Thus, the only coordination that takes place exists because one donor seeks out another to get information or to coordinate actions. The World Bank views itself as ISRA's lead donor and thus responsible for donor coordination. The reality is that there is no one at the World Bank office in Dakar with whom one can confer about agricultural research, which means that urgent questions must be handled over the telephone to Washington or must wait until one of the World Bank project officers visits Senegal. Coordination with ISRA's other major donors, France (CIRAD, ORSTOM, Caisse Centrale), the European Community (CEE, FED), and Canada (IDRC) can be accomplished on a case-by-case basis and there is unanimous recognition of the seriousness of ISRA's institutional constraints. Nevertheless, there is no unified donor effort to address ISRA's institutional problems or to help find the solutions.

The SPAAR Initiative[11]

The Special Program for African Agricultural Research (SPAAR) was created under the auspices of the World Bank to coordinate regional networks in Africa and has developed Frameworks for Action for the Sahel and Southern Africa. SPAAR's mandate has been broadened to include the viability and sustainability of African national agricultural research systems (NARS). SPAAR has started an initiative that could alleviate some of the problems caused by disparate donor involvement/influence in a NARS. A recent meeting of SPAAR representatives discussed four major areas of interest to ISRA: research priorities, consolidated research funding mechanisms, institutional reform, and regional collaboration. The SPAAR meeting stressed the importance of research and research priorities that are responsive to farmer's expectations and constraints within the context of responsible management of all sectors of the natural resource base. National research strategies should be based upon market trends and opportunities, agricultural sector policies, and enhance the linkages between researchers and a broadened client base. Researchers should be held accountable for linkages with the client base. Country research strategies should establish mechanisms for setting and modifying priorities, and define mechanisms for funding the priorities. The research agenda should be set in consultation between national scientists, their clients and policy makers, and in consultation with cooperating partners, including the donors.

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[11] SPAAR 11th Plenary, Abidjan, May 13-14, 1991. Summary of conclusions and decisions.

SPAAR is proposing a mechanism for consolidated research funding that should include: a) provision of adequate recurrent funds for agreed national plans and regional activities implemented within a national context; b) incentives for quality research; and c) sufficient funding for research overheads. The consolidated research funding mechanism is intended to insure adequate funding for ongoing research programs, to address the problem of continuously adding research activities, to allow sufficient time to achieve results, and to allow governments to better coordinate donors. SPAAR proposes that all donors and the host government would use the same mechanism for channelling funds intended for agricultural reseach, but does not detail the modalities for the establishment of such a funding mechanism. This funding mechanism would be independently audited and performance reviewed periodically. The mechanism for each country would have to be country-specific as a 'boilerplate' consolidated funding mechanism across Africa is unlikely.

The SPAAR meeting discussed the requirement of NARS for institutional reform, which includes: management by objectives, decentralization, and improved management tools for programming, monitoring and evaluation of research. Institutional reforms are also country and institute specific. Institutional reforms may be needed to justify the 'hosting' of regional research programs. Improvement of regional collaboration assumes strengthened NARS and an agreed research agenda that operates through networks and regional research programs. NARS will be selected to 'host' a regional program based upon comparative advantage, readiness to pool and share scientific resources, research efficiency, and critical mass. NARS should be involved in the planning, execution, monitoring and evaluation of International Agricultural Research Center (IARC) research programs, making IARCs partners in the realization of a regional research agenda, driven by NARS.

The SPAAR initiative addresses key areas of institutional concern to ISRA. However supportive and encouraging SPAAR may be, unless the GOS and ISRA's donor community are willing and capable of implementing the SPAAR initiative, it will go nowhere.

Ongoing AID Project Activities

Since January 1989, Senegal Agricultural Research II Project[12] has been working with ISRA to strengthen certain institutional aspects. The project is being implemented by Michigan State University. By the end of the project in 1992, the project will have provided more than two person-years (long-term technical assistance) in research planning and management as well as several months short-term technical assistance on specific topics related to institutional strengthening. As senior researchers with administrative experience, the technical assistance in research planning and management has played an advisory role at the Direction General, analyzing specific topics

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[12] The bilateralized Senegal Agricultural Research II Project started in December 1987, but the contract research planner, who actually started the institutional strengthening activities, only arrived in January 1989.

(e.g. research publications and productivity, utility costs, research travel and its consequences, ISRA budget and infrastructure proposals for ISRA reorganization, discussions on the relationship between extension and research) and has offered options for decision-making. Within the General Secretariat, the project has begun the initial analyses necessary for indirect cost calculations and accounting, and improvement in budget reporting. As described earlier, Agricultural Research II Project has funded a grant to ISNAR to work in human resource planning and management. ISNAR's analysis of ISRA's human resources and working documents and recommendations form the basis for changes in the way ISRA manages its personnel. However, to date, most of ISNAR's recommendations remain just that recommendations as ISRA has been unable to implement the systems proposed by ISNAR.

On the research program side, the project has worked with researchers in the crop production department to assist them in planning and budgeting of the research programs, financed under the project, as well as review and evaluation of results. The work in the crop production department is accomplished through short-term technical assistance, which relies on a CRSP-like mode of sustained assistance from the same senior US scientists for cowpeas, millet, sorghum, rainfed corn, and plant pathology. The US scientists make annual visits to ISRA during the agricultural season to check research program progress and ISRA researcher visit the home campuses of the US scientists to evaluate results of the previous growing season and to plan for the following season. Through the project, ISRA was urged to concentrate more on the agronomy and socio-economy of cereals production. The applied economics program has been financed to conduct policy-relevant research in cereals-marketing, food security, pricing policies, and the upsurgence of farmer groups (notably GIE, "groupements d'interet economique"). The applied economics program is also becoming more responsive to the needs of the other research departments at ISRA. The project is reinforcing collaboration between crop production researchers and agricultural economists. It has organized three joint discussion seminars on topics of regional economic simulation of production patterns, economics analysis of trials and marketing of inputs. The applied economics program is proposing to re-package the cereals marketing data which it collected since 1986 and to make it available to all ISRA researchers. Selected research reports are being republished by ISRA (UNIVAL). The project is strengthening the position of the economists at ISRA by providing scientific support through seminars and documentation and by encouraging discussions on topics such as the role and mandate of the economists at ISRA and the importance of micro- vs macro-economics in ISRA's research program.

The project has provided degree training for 6 research scientists (2 PhD, economics and rural sociology; 4 MS, agroforestry, forestry genetics, maize agronomy, and agricultural engineering). Short-term training in agricultural statistics and indirect cost calculations has also been funded.

The project's objectives are to address some of the institutional constraints that were identified before the current institutional and financial crisis overtook ISRA. While the

ongoing activities are small when regarded in the big picture, they do provide a foundation upon which future AID-funded activities can build.

Other ongoing AID project activities that are related to the proposed NRBR project are the Southern Zone Water Management (SZWM) Project and the Senegal Reforestation Project. The SZWM project is working to reclaim land that is no longer cultivated because of salt intrusion. One of the keystones of the project is village participation in the location, construction and management of earthen structures that will reduce salination and thus, allow cultivation. The SZWM project builds upon ISRA's considerable experience in evaluating and monitoring these structures. The SZWM project has funds available for ISRA to conduct studies (soil mapping, structure design, socio-economic evaluation) and to monitor structures constructed under the project. As the SZWM project has just begun implementation, the modalities of the relationship between the SZWM project, the Hydraulics Service, and ISRA have yet to be worked out.

The Senegal Reforestation Project (SRP) works under the Ministry of Rural Development. The project's purpose is to mobilize large-scale popular participation in tree planting with local and private resources by 1993. There are no formal relationships between the SRP and ISRA at present. However, there is a planned natural resources community-based project that will follow upon the popular participation for tree planting of the SRP. It is anticipated that links between the planned natural resources community-based project and the NRBR project will be formalized as the natural resources community-based project will be clients of the research output of the NRBR project.

Networks and Linkages

ISRA maintains scientific contacts with a large number of international, regional and national research organizations and universities. It cooperates with 11 of the 13 International Agricultural Research Centers (IARCs) and participates in many networks including the one recently organized with French Support (CORAF) and as well as SAFGRAD. It maintains extensive relations with CIRAD, the French research service for international development, participates in three AID funded CRSP's (Collaborative Research Support Program) involving cowpeas, peanuts and sorghum/millet, and has worked closely with Michigan State University under A.I.D. financing since 1982.

Thus, ISRA has extensive contacts with the external research community, perhaps too many. The productivity of these relationships is variable across entities and time, but generally there is need to improve the quality and productivity of the most important ones.

WARDA's (West African Rice Development Association) irrigated rice research program is based in St. Louis and utilizes ISRA station facilities at Fanaye. Historically, ISRA has relied on WARDA to carry out a rice research program for the Senegal River Valley. ISRA has not developed its own irrigated

rice programs; its work has been limited to farming systems research that includes rice, water management and fertilization research. Collaboration between WARDA and ISRA has been poor and, not surprisingly, results are minimal. In the last two years, WARDA has joined the CGIAR system, redefined and revitalized its rice research program and started to actively seek collaboration with ISRA. This is a potentially very significant linkage, given WARDA's renewed interest and resources and Senegal's interest in rice in the Fleuve. Nevertheless the impact of WARDA's program on rice production in the Fleuve will certainly depend on whether ISRA builds a viable national program.

ICRISAT (International Crop Research Institute for Semi-Arid and Tropical Agriculture) collaborated with ISRA from 1977 to 1985. Genetic material from ICRISAT and breeding work at Bambey produced two superior synthetic varieties of millet that have been widely adopted in the northern Peanut Basin. But relations were strained and for much of the 1980's the relationship was under-exploited relative to its potential usefulness to ISRA's millet and sorghum program. French participation in ICRISAT's West African network seems to be revitalizing this important link.

ISNAR (International Service for National Agriculture Research) has been working with ISRA under AID-financing since 1988 on improving human resource planning and management. IFPRI (The International Food Policy Research Institute) also with AID-financing, is participating with ISRA in a major agricultural price policy and household budget study which seeks to generate important policy recommendations and build institutional capacity for ISRA to continue a research program in these important areas. Linkages with IITA (International Institute for Tropical Agriculture) have not been very active and cooperation on cowpeas and alley cropping, to cite just two, has been less than desireable.

The French have recently set up a research and networking system for Africa, CORAF. It supports a principal research station in the region for each of the main commodity systems. Senegal has three of the stations - peanut research at Bambey, irrigated corn research at St. Louis and horticultural research at Cambérène outside of Dakar. The concentration of research resources and network facilities is a potentially valuable complement to ISRA's national program.

Again, management and coordination of efforts are key. In sum, important linkages with external research organizations already exist and improvements in the quality of selected linkages could pay big dividents.

Conclusions

Based on foregoing analysis, ISRA has the potential to become a viable, productive national agricultural research system. It possesses important assets that make this possible including: 1) a sufficiently large, diverse and well-trained scientific staff relative to its research mandate; and 2) a well-established research program which addresses the principal commodities in the major ecological zones. In some cases, these programs are built on sound definitions of basic priorities and problems due to the growing acceptance of farming systems methodology; 3) the infrastructure is in place (though deteriorating) to deal with all major commodities in all major ecological zones.

In addition to these assets, ISRA is committed to essential institutional reforms with enlightened leadership which has launched a participatory process engaging its own staff. It has also reached out to cultivate understanding and political support from its own ministry as well as representatives of other ministries (Finance and Planning) and the Presidency. Thus the politics of reform have been well engaged.

Notwithstanding these considerable institutional assets and political commitment to reform, ISRA faces significant challenges, the most urgent of which are: a financial crisis which destabilizes both the institute and its program and a set of financial, research and personnel management issues that must be addressed to make the institute financially viable, administratively effective, technically productive and efficient. The feasibility of meeting these challenges with successful institutional reforms depends on the actions of not only ISRA but the government and ISRA's principal donors as well. From the government, ISRA requires stable, secure funding over the long run; current levels of approximately $6 million (FCFA 1.47 billion) per year are adequate to cover personnel costs and a minimum of operating expenses. From the donors, ISRA needs continued and stable financing consistent with ISRA's research priorities, judicious technical assistance for its institutional reforms, and finally, increased flexibility on the part of donors regarding the financing of indirect costs and short-term contract staff.

With this kind of support, prospects for ISRA to evolve into a viable and productive national research system are good. It must be recognized that there are no realistic alternatives to ISRA for generating the technology required to increase agricultural productivity which lies at the core of Senegal's development challenge. The International Agricultural Research Centers and other external research institutions cannot conduct the adaptive research that must be done in Senegal. While they may be invaluable partners, providing genetic material, research findings and methodological assistance, they can only complement the national program. This principle has been widely validated throughout the world. Nor is the private sector a candidate to assume the burden of conducting Senegal's crop, forestry, fishery and livestock research. Several private voluntary organizations have demonstrated an interest and capacity to undertake useful

but very finite research (e.g., on-farm seed storage, etc.). The commercial private sector which is engaged in input production is small and the market is extremely limited for fertilizer, seeds, pesticides and farm equipment. While the two principal companies engaged in production of these inputs do make modest investments in developing and validating their recommendations for seeds, fertilizer, etc., the scope for expansion is limited. More fundamentally, most of the priority research agenda involves agronomic research on cultural practices, resource management (agro-forestry, water harvesting, watershed management, etc.) and social and economic issues. This kind of research must be supported by the state because it does not afford the private sector the opportunity to develop marketable products. Finally, there is no potential for establishing a private research foundation (as has been done in Latin America and Asia). There is no constituency in Senegal to finance such a foundation either directly or through contract research. (Elsewhere associations representing large commercial farmers have financed meaningful research, though never the entire national system). Small, near-subsistence farmers cannot and will not bear the costs of research. The only other community of interest, the donors, is unlikely to be interested in this idea as it offers no advantages to direct support under the present circumstances.

Thus, there are no plausible alternatives to building a viable national agricultural research system to deal with the central challenge of Senegalese agricultural development. However, the task is feasible if the challenge of continuity, coherence and stability is met.

Recommendations for Project Assistance

1. Technical assistance in research management and planning. It is recommended that a senior scientist (tenured faculty with 10-15 years experience) with both a proven record of scientific accomplishment as well as experience in research program planning and management be recruited as a long-term technical assistant for six years of the project. This individual will be located at the Direction General and will be a counterpart of the Scientific Director. Major tasks that will be assigned to this individual will be:

1. Laying the groundwork for and coordinating a strategic planning exercise that will result in a strategic research plan with a 10-15 year horizon.

2. Along with the strategic plan will be the coordination of the development of a medium-term research plan (5 year horizon) with priorities, staffing and budget possibilities aligned and with realistic objectives. This will include priority setting sessions and team-building exercises to encourage more interdisciplinary collaboration, including farmers or farmer representatives as key participants.

3. On an annual basis, the research planner/manager will work with ISRA scientists and administrators in the preparation of their overall annual research plan and budget (not just the AID-financed research programs). This annual planning exercise must be coordinated with the World Bank and other donors who require approval of annual workplans. Also an annual review of research program progress will take place.

4. This individual will also work with the Unité de Formation et Programmation and the Service d'Administration et Ressource Humains to develop a long-term training plan that will respond to the needs outlined in the strategic plan.

5. This individual will ensure coordination between relevant research departments and program elements within ISRA.

2. Donor coordination meetings. The project should provide funds to hold annual donor coordination meeting to take place before the annual meeting of the Scientific and Technical Committee. These meetings will be planned at least six months in advance to allow participation of a maximum number of donors and if possible, timed to coincide with a visit to Senegal by a World Bank project officer. These meetings will provide a forum for information exchange and to resolve any conflicts and duplications resulting from donor interventions and interests.

3. Technical assistance in financial management will be required for at least the first three years of the project. Three years allows sufficient time to bring the accounts up-to-date, train

necessary personnel, make adjustments in the computerized accounting system, and revise the administrative procedures manual. This individual will work with the General Secretary, the chief accountant (ACP), and the Management Controller and be housed in the General Secretariat and under the supervision of the General Secretary. Qualifications for this position will include 10 years experience in financial management with at least 3 years experience in an agricultural research institute. Knowledge of French and American accounting systems and computerized accounting practices will be required.

4. Training. The PID recommended 15 long-term training programs for scientific staff. It is recommended that at least five medium to long-term (12-24 months) training programs be added for administrative staff, including training in cost accounting, budget monitoring, and management skills. Short-term training and on-the-job training programs will also be planned for administrative and financial personnel. ISRA will take some responsibility in identifying possible training programs available in Dakar (e.g., CESAG).

5. Project administration. The project will hire a project administrator (local hire) for the life-of-project who will assume the day-to-day responsibility for project administration and management. This individual will manage the project accounts, prepare monthly financial reports, and train appropriate ISRA staff in the preparation of financial reports according to AID regulations. Working with the extension specialist/small grants administrator, the project adminstrator will also set up a system to disburse, track and monitor small grant funds and train at least two ISRA employees in this system. ISRA will name one secretary at the SG who will be trained by the project administrator to be the project administrative assistant. The SG and the project administrator will have joint signatory authority on the project accounts. All local currencies to support research programs will be included in the TA contract and the contractor will be responsible for the management and accountability of these funds.

When TA team members are stationed outside Dakar, they will manage local currencies for research program support costs on the basis of advances from the project administrator and SG. The research director or research leader at the center where the TA is stationed will clear on financial reports sent to the project administrator for processing. Each TA team member will have at least one full-time counterpart (preferably more).

Phasing of Project Assistance

The Natural Resources-Based Agricultural Research Project must be phased to avoid skewing ISRA's program and causing an enormous overload of the system. Currently, in the natural resources research program area ISRA does not have the people with which to execute the AID-funded project. The majority of the researchers, with whom the AID project intends to work, are funded by the World Bank, CIRAD, IDRC or other sources, and their time is fully occupied. The World Bank project is supposed to review and approve all research programs it funds on an annual basis. However, for the current cropping season (1991) the World Bank funding of research programs is not tied to any priority and is not focused on any discernable problem. For this year the World Bank project has relieved the urgency of refocusing the research program and trimming down to a leaner more efficient ISRA. ISRA's interest in trying interdisciplinary farmer-oriented research may be limited at the beginning of the AID-funded project. However, as ISRA develops the skills necessary to manage its human and financial resources, the foundation for interdisciplinary natural resources-based research can be laid.

Years 1-3 of the project.

1. Focus 70-80% of the project on institutional strengthening - nuts and bolts. Meaning working to resolve management problems - administrative, financial and research. LT technical assistance will be required for financial management and research planning/management. ST technical assistance will be needed for the 'shock force' to get the accounting system in order; to work on a training plan; to train administrative staff from top to bottom in the skills that are necessary to become more effective. Part of the institutional strengthening effort in years 1-3 will be a deliberate donor coordination effort.

2. The 20% of the project will cover focused research activities of limited duration. The majority of these resources will need to complete a technology inventory in Senegal and in the region. Tied to this technology inventory there is a need for economic/financial analysis of the identified technologies and a sociological analysis of constraints to adoption. To accomplish this study the project will need to fund at least two outside people (one NRM researcher and one production economist) for a period of 6-12 months.[13] ISRA has a PhD rural sociologist, who has recently returned from training, and has not established his research program. This individual could be funded to conduct the sociological analysis of the technical inventory. ISRA's only production economist is not fully funded and perhaps could be detailed to participate in this analysis of technologies. From this inventory there will be a list of possible choices for further research adaptation or validation. A proposal or

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[13] One possible source for 'outside' consultants to conduct the technology inventory is the Institut de Science de l'Environnement at the University of Dakar. The director of ISE is also a member of ISRA's scientific and technical committee.

research plan could be generated from the inventory to specify possible technologies and the zones where they could be tested. This plan would be discussed with ISRA researchers (and management) to determine the interest and the personnel available to focus on these technologies. It is possible that a researcher could be used only marginally and that the bulk of the 'work' to do falls upon a NGO or farmer group with the researcher (or a technician) just checking and monitoring the activity.

3. Ten percent of the project (Year 1-3) will be focused on limited support for research programs where there is already the spark to involve farmers and where the program is working in natural resource management research. Specific research 'windows of opportunity' currently exist at ISRA where AID funding can be used to encourage some research programs to work more with farmers or to expand their area of coverage. Two specific examples:

a) The Kaolack NRM group (already doing excellent work) is almost fully funded (CIRAD, ORSTOM) however, they have expressed the desire to expand their area of coverage to the Fatick region but do not have the funds (meaning vehicle and gas mostly) to do so. The agroforester and livestock systems person are underfunded. The project could pick up some of their research program costs. The underlying assumption is that AID and the TA team will coordinate activities closely with CIRAD/ORSTOM to avoid duplication.

b) The ISRA agronomist at Nioro wants to work with farmers are low-input techiques that build soil fertility and to evaluate these techniques agronomically and socio-economically. He has already done some trials, but his main constraint is no vehicle or money for gas. The project could provide these things, plus funding for an economist to evaluate what he is doing.

Years 3-7 of the project

By the end of year 3, the ISRA should have a new medium-term research plan based upon farm-level constraints and market realities, on the one hand, and on the other, ISRA's institutional (human resources, infrastructure, etc.) and financial capabilities to execute the plan. The research planner should have played an advisory role in the development of this research plan. ISRA's administrative and financial capabilities should be adequately strengthened by this time so that these current weaknesses do not hamper the execution of the new research plan. By the end of year 3, the project should fund an evaluation that would determine if ISRA is capable of executing its medium-term research plan (whether a totally new plan or a revision of the old 5 year plan), and whether the purpose of the natural resources-based project is appropriate and attainable. If ISRA has not shown improved capabilities to manage and execute the AID-funded project as part of its overall research program, then AID should be willing to walk away from the project and leave ISRA to its other donors.

Project Design Issues

1. Is this the appropriate time to start a new project focused on natural resources-based cropping systems? Will this new project skew the fragile research priorities that exist?

Response: Yes to the first question and no to the second. Given the ISRA reform agenda and the move toward more efficient use of researcher via interdisciplinary collaboration, the natural resources focus provides the perfect vehicle for this approach. From a certain perspective, one could say that natural resource management research exists at ISRA, although divided into pieces (agroforestry, soil/water management and conservation, soil microbiology, etc.), not interdisciplinary (except at Kaolack) and it is not called NRM research. Given the lack of coordinated NRM research approach at ISRA and the importance the CST (for the forestry and livestock research departments) and the consultative commission place upon NRM research as well as the interest of two of ISRA's major donors (World Bank and AID) in research that addresses the natural resource base, the fundamental constraint to improved agricultural production in Senegal, the focus is appropriate. The timing and phasing of project activities are key to the success of the project. Institutional management weaknesses must be addressed first (years 1-3 of the project). Research activities should be phased in starting with very limited activities in years 1-3, and build upon the foundation established early in the project.

2. Who will have the responsibilities of team leader/chief-of-party, where will this person be located and how will this person function?

Response: The PID proposed that the research planner would also be the TA chief-of-party, as this individual will be a senior scientist, and located at the DG with overall planning responsibilities. ISRA has raised the issue that they would prefer that the research planner have no administrative responsibilities. As described above, the project administrator can assume a major role in the day-to-day project operations, but will not be senior enough to supervise the other TA members. ISRA has proposed that perhaps the project hire one research manager who would work ISRA-wide on all aspects of management. The project would hire a second individual as a research planner who would work with the scientific director strictly on research planning. This issue is unresolved and requires further discussion.

3. ISRA has asked if the project will allow ISRA to hire researchers or administrators with project funds who will fill positions during the project with the hope that their positions will be 'regularized' by the end of the project and ISRA will have the funds to support their positions. ISRA has also expressed its concerns that there are not enough researchers or administrators to serve as counterparts for the TA and that hiring from the outside is the only way around this problem. This proposition also holds for individuals that ISRA would like

to recruit and then send off for long-term training, hoping that their positions would be funded upon return.

Response: AID's position in the past has been that AID-financed projects do not fund host-government employee salaries. ISRA has just experienced a staff reduction (although not in research staff). ISRA's desire to expand its personnel numbers goes counter to the reform measures that have been taken to date. ISRA has criticized AID in the past for its technical assistants and their location outside the ISRA 'system' and their lack of counterparts. It is imperative that all TA have at least one counterpart (if not more). If the amount of TA proposed is too much or if the proposed project is too large for ISRA to absorb at present, then the TA needs to be phased so that ISRA counterparts are available. It would be extremely counterproductive to hire individuals to serve as counterparts to the project's TA, only to have those individuals returned to unemployment when the project ended.

Recommendation: That project funds <u>not</u> be used to pay ISRA salaries, other than specific short-term consultancies as as proposed under the small grants program. If local currency generations from the agricultural sector grant become available during the project, these funds could be used to pay salaries. However, ISRA must learn to function with a smaller staff and align its research program and priorities accordingly. This project is working towards that goal and ISRA's commitment to live within its means (both human and financial) must be insured for the project to succeed in strengthening institutional capacity.

Considerations for Project Monitoring of Institutional Strengthening Objectives

Quantitative measures that indicate institutional strengthening are difficult specify. Most indicators are process-oriented. It is more practical to identify 6-8 critical questions under each objective, and to review and document the process at the beginning of the project and to monitor the process at regular intervals of 2 years (Time-1, Time 2, etc.) to identify progress.

In certain cases, quantitative assessments can be made (e.g. number of tests planned, number implemented, number successfully completed and analyzed, number reported, reduced time lag between data collection, analysis and reporting; number of scientific publications; number of popular publications; percentage research effort devoted to on-station vs. on-farm research; number of practices, technologies tested and released; adoption rates; yield/income increases per farm or per labor unit). The heart of institutional strengthening and development lies in the improved management process. Therefore, 'before and after' documentation of the process and procedures is invaluable.

Generally, there are three major objectives of institutional strengthening in the NRBAR project. The cross-cutting theme for all three objectives is management.

1. The ability to plan and manage research programs effectively. The questions should be asked to identify indicators of progress-impact.

Q.1: What is the research planning process? What is the mechanism? Who is involved? How are the priorities established to reflect national needs, farmer priorities and production constraints? How are short and long term needs balanced?

Q.2: What are the research strategies relating to the development of crop technologies and natural resources management?

Q.3: How is the research coordinated between different divisions or program elements? How best complementarities are exploited to increase cost-effectiveness?

Q.4: What is the process of resource allocation between priority programs?

Q.5: How well the external resources are integrated into the research planning, managed and accounted?

Q.6: How well managed are research-outreach (extension, NGOs, farmer groups, private industry) linkages/relationships?

Q.7: Are specific research programs based on budgets? Is each discrete research activity budgeted? How are budgets controlled and monitored?

Q.8: How is the research implementation supervised and monitored?

Q.9: How effectively and timely are data collected, analyzed and reported?

Q10: What is the process of evaluation of research programs? Who is involved and how frequently are programs evaluated? What is the criteria for dropping and modifying research programs?

Q11: How effective is the communication between various hierarchical levels within ISRA? Does information flow freely from bottom to top?

Q12: How is individual innovation and initiative rewarded by the system?

2. Improvement of financial management and accountability. The financial management specialist should develop these questions and identify the indicators/measures of progress.

Q.1: Is there an efficient financial management system which accounts for all funds/resources coming into the system and spent/invested?

Q.2: Are there sound financial management procedures and controls?

Q.3: Is there an inventory control and management system?

Q.4: How is the budgeting process managed? Who is involved? How are the budgets implemented and reported?

Q.5: How credible are the purchase and payment procedures?

Q.6: Who receives the financial management reports? How frequently? What kind of management information is provided? How are these reports used?

3. Human resource development. Because of economic constraints, ISRA's human resource development basically translates into training related activities. ISRA has little to offer its staff in terms of incentives and promotions and other material rewards. Realism is important in measuring impact of human resource development strengthening.

Q.1: Is there a staffing pattern for each program which identifies job description, qualifications, and experience of staff required to fill those positions?

SOCIAL SOUNDNESS ANALYSIS

I. Introduction/Summary

II. Livelihood Systems in the Project Zone

Ethnic Considerations in Livelihood Systems
Gender Issues in Livelihood Systems
A Note on the Organization of Agriculture

III. The Relevance of a Natural Resources-Based Agricultural Research Program

IV. The Farmer Participatory Research Imperative

V. The Practical Modalities of Establishing a Farmer Participatory Research Process Around Improved Natural Resource Management: The Advantages of Working With Farmer Associations, Village Committees, and NGOs

Three Categories of Partners
Characteristics of Potential Partner Organizations
Le Programme de Recherche-Appui des Associations Paysannes

VI. Possible Constraints to Effective Farmer Participatory Research (With Recommendations)

VII. Possible Constraints to Farmer Adoption of Natural Resources-Based Technologies

Labor Constraint
Water Shortages
Land and Tree Tenure Problems
Skewed Resource Endowments (Capital and Animals)
The Need for Leadership and Political Mobilization

VIII. Winners and Losers

I. INTRODUCTION/SUMMARY

The Natural Resources-Based Agricultural Research (NRBAR) project seeks to increase the productivity of cereals-based farming systems by improving local level management of natural resources. This contrasts with past efforts to increase agricultural productivity principally through use of purchased inputs and improved varieties. Three aspects of the project are particularly important from a social soundness perspective since they will significantly affect the number and range of beneficiaries.

1. The project's goal -- to increase productivity through better management of natural resources -- is highly relevant now when Senegalese farmers' ability to feed their families has been severely eroded as a result of (a) natural phenomena including declining rainfall and (b) national policies reducing agricultural subsidies for fertilizer, seeds, and other inputs.

2. The process envisaged to meet this goal -- farmer participatory research -- is a sound way of generating technologies and increasing the probability of their adoption. Research which begins with the farmers' preeminent concerns and develops improved technologies and techniques using the resources they have available is likely to be socially sound and to maximize the number of project beneficiaries.

3. The project's emphasis on collaborating with farmers' associations throughout the research process should significantly increase its spread effect. Such associations comprise a burgooning element in the sociological map of rural Senegal and offer considerable advantages in mobilizing rural populations, facilitating both lateral and vertical communication, and encouraging more equitable and productive partnerships between scientists and farmers.

In short, the principles underlying this project are sound. The proposal is both timely and relevant to current development issues in Senegal. It would be a mistake, however, to underestimate the challenges ahead in institutionalizing a participatory research process that will lead to real benefits for significant numbers of farmers.

Technically, the project seeks to increase productivity on farms where yields have been steadily deteriorating and ecological conditions are getting worse, not better. Under such conditions, halting further deterioration of the resource base will be an accomplishment, obtaining marginal productivity increases would be a notable success, and generating dramatic yield improvements for vast numbers of farmers should be recognized for what it is: an eminently desirable but almost certainly unrealistic objective.
Institutionally, the project seeks to encourage collegial research relationships between farmers and scientists in an institute which appears to be, at most, lukewarm to such an approach. While good initiatives in this direction have already begun, systematically incorporating "farmer first" perspectives as a balanced and

integrated part of the larger research program at ISRA will require a concerted and sustained effort.

These cautionary considerations are intended to fuel rather than discourage the NRBAR initiative. Only by explicitly acknowledging the depth of the problem and expressly confronting the difficulties of implementing solutions will sufficient efforts be mobilized to effect changes reaching all the way to the farmer. To succeed, the NRBAR project will need leadership as inspired and personnel as committed as the wealth of financial resources it marshals.

II. LIVELIHOOD SYSTEMS IN THE PROJECT ZONE

The zone covered by this project (400mm annual rainfall or higher) covers virtually all the ethnic groups in Senegal and represents a tremendous diversity of production and livelihood strategies. Within this great range, certain characteristic trends that are relevant to the vast majority of small farm households can be identified. Chief among these is the increasing difficulty faced by virtually all small producers in meeting their family grain consumption needs, whether by cultivating their own coarse grains or by producing cash crops that are sold to buy cereals. Many stocks of homegrown grains are consumed within (and often long before) six months of the harvest, leaving families to put together a patchwork of strategies to assure their food needs during the remainder of the year. (Diagana, Dugué, Gaye, Goetz) The evidence is clear that Senegalese farmers do not try to be self-sufficient in cereals, but rather that they seek food security. In many cases this involves purposely diversifying their production and activity portfolio in order to earn money which can be used to buy cereals (Gaye).

In the past, export cash crops, mainly peanuts and cotton, generated much of the income needed to cover any grain deficit. However, difficulties in conserving peanut seeds now that the government is no longer involved in distribution as well as precipitous drops in the producer price of cotton are forcing farm families increasingly to depend on alternate sources of income. Village level studies suggest that the most notable characteristic of the strategies employed to meet this food deficit is their intricate diversity (Fall, RRA: Samkedj). Generalizations can mask enormous underlying variation: responses vary not only between regions but also among neighbors living in apparently similar conditions. Activities which hardly appear in national statistics may have significant effects on local incomes and, cumulatively, on Senegalese farmers' food security. A single family may be involved in cultivation, commerce, forest product collection, animal raising, and a host of other activities, each of which makes an essential contribution to family income. Others tend to specialize more, earning larger sums from fewer activities.

One patch (or several) in the villager's livelihood quilt is represented by alternate cash crops such as cassava, melons, sweet potatoes, and pumpkins. Farmers in some areas report that the

225

income from these crops now exceeds the revenues formerly earned from peanuts (RRA:Samkedj, RRA:Faraba). In areas proximate to markets, dry season gardening may contribute to incomes. For most farmers, animals play a critical role in the livelihood strategy (Diagana et al). There are few families who do not raise at least small animals (chickens, goats, or sheep) and, when their means permit, farmers invest in larger animals including donkeys, horses, and cows. Large animals provide inputs to agricultural production in the form of labor and manure and may generate small but regular revenues from the sale of milk. Both large and small animals are a principal form of saving and it is not at all uncommon to find families selling chickens or goats in order to buy grain during the hungry months before the harvest.

Trees crops and forest products are important to many families' strategies. Sizeable income may be earned from such well-recognized "orchard" crops as mangoes and oranges but diverse local fruits and a whole range of products are collected from trees in fields, forests, and common areas. These include the leaves, bark, fruits, and wood of diverse trees and bushes, among the better known of which are the baobab, tamarind, kinkileba, and rat (combretum), as well as dozens of other species. (For a list of 105 species valued for their food use in Senegal see Bergeret and Ribot.) Some of these products enter directly into family consumption and are particularly important during the hungry season when other alternatives are scarce while others are sold and make an important contribution to, particularly, women's income (RRA:Samkedji). Men exploit the forest too, harvesting palm fronds, bamboo, honey, straw, and sticks which are transformed or sold directly (RRA:Faraba).

In addition to their local activities, many farmers leave the village during the dry season in search of off-farm employment, often commerce, or have relatives working on a long-term basis outside the village and hence receive remittances on a more or less regular schedule. Other activities contributing to farmers' livelihoods include fishing, food transformation, and crafts. A recent survey in three villages in the heart of the peanut basin found that 125 respondents (men and women) were engaged in a total of 35 different income generating activities, in addition to agricultural production (ISRA/IFPRI study ongoing).

Ethnic Considerations in Livelihood Systems

While in the past clear differences could be seen between the agricultural and livelihood systems of various ethnic groups, these distinctions are tending to blur as farmers seek to diversify their food and income strategies and are forced to contend with shortages of both natural resources (including rainfall) and "modern" inputs. Hence, the traditional Serer systems of communal granaries to meet hungry seasons needs, though they have not disappeared altogether, are far less common than they were in the past (Lombard) as severe cereals shortfalls drive people into dry season employment and more individual systems of food security. Wolofs, who were known for practicing extensive and not particularly sustainable agriculture,

are increasingly adopting the more sustainable practices previously used by the Serers and paying greater attention to protecting trees and integrating livestock and crop production (Seyler: personal communication). Diolas, once known as rice farmers par excellence have been forced by drought to diversify into other crops and many now buy more rice than they produce (personal experience). Peuls, who have a special reputation as cattle raisers are, particularly in the 400+ rainfall zone, consummate cultivators and many are no better endowed with cattle than the other ethnic groups with whom they share the territory (RRA:Faraba, RRA: Linkering, RRA: Guiro Yoro Alpha).

Gender Issues in Livelihood Systems

A gender overlay on this complex and evolving scenario poses additional challenges to the conventional wisdom. Women are active participants in all sectors of the farming system (cultivating cash and food crops, owning animals, participating in forestry activities) and dominate certain sectors such as gardening and forest product collection. Increasing economic and food security pressures have in many cases diminished traditional distinctions between men's and women's responsibilities in the household economy. Thus, while traditionally men were usually responsible for assuring the family grain supply, whether grown or bought, and women took charge of the complementary sauces and condiments, rural people now laugh when presented with such a dichotomy. "Who will sit and cross their arms when the family is hungry?" responded one farmer when discussing the responsibilities of men and women in assuring basic food needs (RRA:Guiro Yoro Alpha). In general, hard times have obliged women to seek income generating opportunities more vigorously and to devote a larger part of their revenues to family subsistence than in the past.

In agriculture, decision making and the division of labor between men and women varies considerably. In most cases, men take principal responsibility for decisions concerning the family cereals fields (except in the Diola system of rice cultivation where that role is taken by women) and also cultivate cash crops. The size and composition of women's fields, and whether there are shared fields or exchanges of labor between men and women depend on such factors as ethnic group, the level of mechanization and type of crops cultivated, and the availability of land and labor.

Gender issues are particularly important in evaluating time constraints to technology adoption since men and women face different seasonal and daily labor calendars. Perhaps the only valid generalization which holds true in this context is that while both men and women work extremely hard during the agricultural season, women bear the additional burden of maintaining the household. Both tend to have more available time during the dry season, but once again women have less disposable time due to their never-ending household chores (Teague). Since it is impossible to usefully generalize about such labor concerns it is essential that detailed studies of local labor issues are a part of any research leading to technology development.

A Note on the Organization of Agriculture

By far the majority of agricultural production in the project area is carried out by small-holder farmers. There are, however, a certain number of irrigated projects in the zone (the Anamb rice scheme near Velingara for example), and sizeable tracts of land in the peanut basin are devoted to commercial peanut production organized by religious leaders. These marabouts are central to any discussion of natural resource management in the peanut basin because (1) their commercial production practices, which have involved cutting trees in order to cultivate vast tracts of peanuts using mechanized equipment on fragile sandy soils, have led to significant soil degradation over the last decades and (2) as respected leaders they have great influence over large numbers of small-holders in the region.

The significance of the marabout's influence and impact is evident from their recent mobilization of tens of thousands of talib s to clear 45,000 hectares of classified sylvo-pastoral reserve in order to plant peanuts. This action was a major affront to sustainable resource use in the region and, in a single blow, affected land areas comparable in size to that which could be painstakingly regenerated by working with some 5-10,000 household farmers. Hence, much benefit could come of encouraging these opinion leaders to make their own production practices more sustainable and to persuade their followers to adopt more environmentally sound practices.

This analysis emphasizes diversity and focuses on farmers' adaptive, evolving livelihood strategies rather than describing some "average" farming systems by ethnic group or region. This is because in today's context, such generalizations obscure and distort more than they illuminate. Senegalese rural communities have proved themselves to be both creative and opportunistic in searching for new and more diverse food security strategies. They have adopted new activities and adapted traditional systems of social organization in the face of ever exacerbating economic and environmental hazards. As will be discussed shortly, this has important implications for research: it will be of no use to farmers unless it responds to the complexity and diversity of their reality.

III. THE RELEVANCE OF A NATURAL RESOURCES-BASED AGRICULTURAL RESEARCH PROGRAM

Sahelian farmers are natural resource managers. Denizens of a harsh and capricious environment, their survival depends on their ability to use the slim but diverse resources at their disposal to ensure the sustainability of their households. As described above, for most farm families in Senegal the overriding concern is assuring food security and the overriding strategy is opportunistic diversification. Natural resources play a critical role in this strategy, both as inputs to the integrated functioning of the system

(e.g. leaves to feed animals which in turn manure crops) and as direct contributors to food security (e.g. revenue from forest products which is used to buy staple foods, or forest foods which are consumed directly).

Unfortunately, past development efforts have done more to undermine farmers' indigenous knowledge of natural resource management than to expand or nurture it. Practices now considered suboptimal are often the result of misguided advice and ill considered incentives to farmers. The consumption of difficult to grow and nutritionally inferior "Tubop" vegetables has been encouraged in the place of more easily harvestable leaves from wild plants and trees (Bergeret). Massive efforts have been devoted to persuading villagers to establish single species village woodlots, sometimes replacing more diverse -- and potentially useful -- natural formations (Seyler). Farmers who are now exhorted to protect Acacia albida in their fields were formerly given food aid to uproot trees perceived as impediments to mechanization and improved cultivation practices (personal communication: Mbir Diouf, farmer in Lambokh).

Senegalese farmers have nevertheless succeeded in maintaining a considerable body of traditional knowledge concerning the value and management of natural resources. Examples include the Serer's carefully integrated systems for maintaining soil fertility (Pellisier), the Peul's highly developed knowledge of grasses and grassland regeneration (Diallo), the Maure's expertise in tapping and managing natural groves of gum arabic trees (Freudenberger), and ancient methods of composting in which plants are grown on weed piles in the Haute Casamance (Gamble and McPeak).

Farmers face increasing incentives to use their resources more efficiently as other inputs (rainfall, fertilizer) become more scarce or expensive and as poor harvests and worsening economic conditions oblige farmers to seek new sources of food and income. Hence a natural resource based-agricultural research project is both timely and relevant. The knowledge of formal science may offer suggestions to refine or improve traditional and evolving systems of management. As Robert Chambers points out, however, "improvement" in this context is likely to imply increasing complexity -- adding options which permit even greater diversification -- rather than seeking to simplify and standardize as scientists have more often done in the past ("New Directions").

IV. THE FARMER PARTICIPATORY RESEARCH IMPERATIVE

It is in this context that farmer participatory research offers its greatest pay-off. The benefits of incorporating the farmer as a contributor to, rather than merely passive adopter of, research results grow as the farming system -- and the interactions between its elements -- becomes more complex (Sumberg and Okali). To have any hope of improving local resource management, the research agenda must reflect the farmers' concerns and their objectives; the research process must take advantage of their intimate knowledge of

local conditions; any research recommendations must be compatible with farmers' constraints; and the extension strategy must be consistent with their risk-diffusing decision making strategies. Adoption rates are thus likely to be higher when farmers are presented with a smorgasbord of choices from which they will select as a function of highly localized conditions and needs rather than a standardized package of recommended practices which are unlikely to meet any real set of conditions even if they were designed with some overall average in mind (Chambers, TTED).

The need to adopt a fully integrated systems approach toward natural resource use, the immense diversity of strategies employed by Senegalese farmers, and the high variability of local conditions all converge toward a single strategic observation: the success of this project will depend on its ability to effectively incorporate farmer participation in the research process.

This project's emphasis on "farmer participatory research" does not and should not suggest that on-station or in-laboratory research is unimportant. In fact, laboratory, station and participatory research are not only compatible: they should in all cases be mutually reinforcing. The problem is that traditional "transfer of technology" research/extension models continue to dominate institutes such as ISRA. In this model, the end-user has been treated as a passive receiver to be convinced of the utility of research results rather than an active participant in the research process itself. Even though the ToT model has resulted in modest adoption rates, tradition and the "normal professional" training of researchers continues to reinforce and perpetuate top-down processes. Given existing biases, in order to reach an appropriate balance between ToT and farmer participatory research processes, it is necessary at this stage to give special encouragement, incentives, and resources to the latter.

The path toward farmer participatory research has been trod firm both by those whose advocacy stems from an ideological conviction that all research and development actions should implicate as equal or preeminent partners the people they are intended to benefit as well as by those who are motivated more by pragmatism than by ideology. The failure to tap indigenous knowledge is both wasteful and counterproductive since innovations that are not compatible with farmers' knowledge systems (either building on them or, where necessary, persuasively correcting them) will remain largely unadopted. Farmer participatory research seeks a partnership between the "scientific researcher" and the "farmer researcher" in which each brings knowledge and ideas to the process, is prepared to correct misconceptions held by the other party, and equally, is prepared to be corrected if there is convincing evidence contradicting his/her beliefs.

In practice, a wide range of research activities, many falling short of this partnership model, masquerade as farmer participatory research. Biggs describes a continuum of farmer-- scientist relationships. At the bottom end, in terms of the farmer's role, is

a contract relationship in which the farmer essentially carries out a research trial designed by the scientist. The next, described as a consultative relationship, is similar to doctor and patient: the farmer provides some information but the scientist is clearly dominant and does all the thinking. In a collaborative relationship there is sustained interaction between farmers and scientists and a certain exchange of ideas. And finally, Biggs suggests that the collegiate relationship implies not only that the farmer contributes ideas but that the process actually enhances his/her capacity to conduct research and to make demands on the formal scientific community (Biggs cited in Farmer First, p. 167). The first two still fall under the ToT paradigm, merely transferring an essentially top-down model from the station to the farmer's field, the third is on the borderline between ToT and FPR, and only the fourth qualifies as genuine farmer participatory research.

ISRA's experience has progressed systematically in the direction of on-farm research and more haltingly towards farmer participatory research. In the 1970s, the "Unités Experimentales", which were forward looking in their time, brought the scientists (though still with their own agendas) at least nearer to the farmers' fields and gave them a closer view of villagers' constraints. In the 80s, ISRA researchers were again in the forefront in West Africa as they put Production Systems Research teams in place. These multi-disciplinary teams began to systematically include on-farm and with-farmer work in their activities (Bingen and Faye). Certain of the Systems teams, and especially the Casamance based team at Djibelor, have made regular progress toward using ever more participatory research methods. Their work merits encouragement, support, and emulation, as well as continued efforts to build more collegial relations with farmer partners. It must equally be recognized, however, that there are still many researchers at ISRA who have little or no experience in FPR and others who consider that their work is participatory when in fact under the Biggs scheme it would be considered strictly contractual or, at best, consultative.

V. THE PRACTICAL MODALITIES OF ESTABLISHING A FARMER PARTICIPATORY RESEARCH PROCESS AROUND IMPROVED NATURAL RESOURCE MANAGEMENT: THE ADVANTAGES OF WORKING WITH FARMER ASSOCIATIONS, VILLAGE COMMITTEES, AND NGOS.

While farmer participatory research linkages can be established directly between scientists and individual farmers, the project will encourage scientists to develop linkages with already established organizations such as farmer associations, village organizations, and NGOs. These groups can play a significant role in helping to establish a partnership between scientists and farmers, can facilitate communications between the two during the research process, and can widely and quickly disseminate results among their members. Specifically:

Role 1. Strengthen the farmer side of the scientist-farmer equation.

The relationship between scientist and farmer is at once delicate and absolutely critical to producing useful research results. Farmers may at first feel intimidated in collaborating as equal partners with formally educated people and reluctant to express their knowledge and ideas. NGOs which are known to the local population and associations which explicitly represent their interests can effectively encourage the farmers to present themselves more forcefully. They can also usefully monitor the relationship to ensure that mutually respectful attitudes are maintained. Example: ARAF (an association based in Fatick) collaborated with several other associations last year to host a conference bringing banking and formal credit systems representatives together with farmers. Whereas individual farmers are often treated with disdain by such institutions, villagers reported that they held their own in the meeting and that discussions were frank, balanced, and apparently instructive for both sides.

Role 2. Facilitate communication in the short-run and build better communication skills in the long-run.

Communications barriers can be as simple as the lack of common language between scientists and farmers or as complicated as establishing trust and respectful ways of listening. To the extent that association representatives and NGOs usually have experience working at both the village level and with more formally educated people, they can help to mediate and interpret between the two parties. At the beginning this may mean holding meetings bringing the two groups together, helping to select villages where research will take place, etc. Over time the associations may, by example and more formal training sessions, be able to build up the communications skills of both side in ways that facilitate direct interaction and mutual trust.

Example: The NGO Rodale is currently facilitating ISRA-farmer interaction in the Thies region. Some of the participating researchers had never worked directly with villagers before this experience and it is helping them to develop more effective communication skills.

Role 3. To balance the research-development equation.

While many farmers will be greatly interested by a research process which is geared to their needs, it may be hard for them to accept that benefits of research do not accrue for months or even years. As with any research, some of their experiments may fail or have disappointing results. In the meantime, all their other problems continue. Associations and NGOs are usually involved in development activities which provide more immediate and tangible benefits. When these are combined with research the package becomes more interesting to the farmer than the research activity alone.

Example: CADEF works with ISRA and farmers to facilitate on-farm trials but also has a credit programs which enables farmers to purchase agricultural equipment, peanut seed, etc.

Role 4. To disseminate information among members.

The most evident benefit of working with local, broad-based organizations is their ability to circulate information among their members or (in the case of NGOs) to the other villages where they work. This is an essential factor for achieving the "spread effects" anticipated by the project. Most local associations are structured so that information passes smoothly between different vertical levels of their hierarchy. Example: ARAF is organized into village groups which coordinate in unions at the arrondissement level; CADEF is organized at the "group", "sector" and "territory" level. In addition, they sponsor activities designed to pass information laterally among villagers. Example: Rodale's field days, ARAF's study visits, and AJAC's annual meeting which rotates between villages.

In the "smorgasbord" approach to extension where the farmer is encouraged to select what s/he finds most appropriate from among a range of options, the rapid and wide dissemination of ideas through networks of local associations is a great advantage.

Example: Farmers who are already participating in research activities with CADEF and ARAF report that information from their tests is quickly spread along the association grapevine. They receive numerous visits from farmers who hear of what they are doing and are interested in seeing for themselves. Ideas are passed not only within associations but between them since visits are exchanged with groups in different areas. Umbrella associations such as CORD, in the Casamance, and FONGS, nationally, facilitate such exchanges.

Three Categories of Partners

Three kinds of organizations may serve as potential partners in such a triangular relationship involving farmers, scientists, and a mediating/facilitating organization. Best known are the international (e.g. Rodale, Catholic Relief Services) and African or national (e.g. RADI, AFOTECH) NGOs. These organizations usually work locally, but are staffed and funded from outside the study area.

In contrast to the NGOs, Farmers Associations are membership organizations whose leadership usually comes originally from the area, though the principal leaders are often urban transplants. These grass-roots organizations, some of which are limited to a few villages while others cover entire zones, have become significant features in Senegal's sociological landscape over the last decade. As the government's ability to provide rural services has declined, local organizations have sprung up to address farmers' needs and to devise more locally responsive development strategies. Funding for these associations comes, increasingly, from international donors though the associations' agendas, in principle, reflect the interests of local constituencies. More than 25 well-established associations, ranging in size from several hundred to more than 10,000 members already exist in Senegal and their numbers are rapidly multiplying (PRAAP).

The third type of potential partner is the village based organization or committee which coalesces around a specific need or interest group (e.g. women's gardening group, forest protection committee). Such groups rarely have outside funding unless it may be to support a project in which they participate. They rarely cover more than one village and rarely have members from outside the village. These characteristics limit their effectiveness in disseminating information and serving as mediators with scientists. However, such groups can very usefully replace the individual farmer as research partner when the problem being researched extends well beyond private fields (as with watershed development). Jim Seyler's work in the peanut basin uncovered a number of such village groups ("comités de surveillance") which are already organized around resource management issues (Seyler).

The list below suggests possible strengths (+) and weaknesses (-) related to each group's potential in facilitating participatory research. In cases where a village committee is chosen, it will probably make sense to work with an NGO or association as well since their characteristics are complementary rather than duplicative. Within each category, particular organizations have widely varying characteristics, strengths, and limitations. ISRA researcher teams will have to do preliminary studies to determine which are best able to provide complementary skills and services.

1. Selected Characteristics of International or National NGOs

+ usually experienced in communication
+ usually have women staff
+ usually have complementary development projects

o may or may not have trust of population
o may or may not have experience in agriculture and resource management

- usually not lasting presence
- may not transfer skills but merely fill a function (communicating for scientists rather than training them as communicators)
- may project own agenda rather than farmer's

2. Selected Characteristics of Farmer Associations

+ usually represent farmer interests
+ usually have farmer confidence
+ usually effective in promoting lateral communication between farmers
+ likely to be useful in vertical (scientist:farmer) communication
+ usually good at promoting farmer self-confidence, solidarity
+ supporting them is an investment in rural Senegal

- o may or may not be gender sensitive
- o leadership may or may not be representative of grass-roots, may or may not be accountable
- o may or may not understand concept of research
- o may or may not be durable

- \- often have management difficulties
- \- often relatively fragile, easy to swamp

3. Selected Characteristics of Village resource management groups

- \+ members and leadership are farmers themselves
- \+ highly knowledgeable about local level
- \+ already demonstrated interest in NRM

- \- usually don't have many links with other farmers
- \- unlikely to solve communication problem
- \- relatively difficult to identify

Le Programme de Recherche-Appui des Associations Paysannes (PRAAP)

A discussion of research partnerships would be incomplete without mention of a new program (PRAAP) which has its headquarters in Dakar and intends to "facilitate participatory research and planning activities that strengthen the capacity of multi-village farmer associations in Guinea, Senegal, Mali, Guinea Bissau, and Gambia." The program, which is currently financed by the Canadian International Development Research Centre (IDRC) and the Ford Foundation and is sponsored by Innovations et R seaux pour le D veloppement (IRED), hopes eventually to establish a foundation to provide continuing support to farmers associations.

Two of the program's objectives are particularly relevant to this project: (1) to develop, test, and diffuse participatory research methodologies that can be used by the associations and their national partners; and (2) to facilitate and strengthen healthy relationships of collaboration between associations, national institutions, and resource-persons working on specific problems faced by farmers (PRAAP).

The current program coordinator is a former researcher with the ISRA Djibelor program. While PRAAP is only recently established and is still working out its program of activities, it appears that there will be numerous areas of mutual interest and substantial opportunities for collaboration with the NRBAR project. These should be explored more fully as both get underway.

VI. POSSIBLE CONSTRAINTS TO EFFECTIVE FARMER PARTICIPATORY RESEARCH (WITH RECOMMENDATIONS)

There are numerous obstacles to be overcome in institutionalizing such a participatory research process; the most intransigent are

related to decades of accumulated habits and attitudes. Traditional research processes thrived on the lonely brilliance of individual and occasionally eccentric scientists. Successful farmer participatory research depends on (1) the ability of scientists to work well in teams which can confront the systemic aspects of farmer problems and (2) the establishment of a deep and lasting rapport between scientist and farmer researchers. Multi-disciplinarity and effective communications are not merely decorative aspects in the FPR process, they are core and absolutely essential elements.

Unfortunately, the training and experience of both intellectuals and farmers is frequently counterproductive to such an approach. Scientists often have little training or interest in tapping the knowledge of formally-uneducated people and often harbor superior and implicitly arrogant attitudes which are barriers to developing their abilities in this area. Farmers, after years of being treated as unknowledgeable and backward by "experts", have been acculturated into public attitudes of dependence and inferiority. Since both perspectives are rampant (though fortunately not universal), mutually reinforcing, and absolutely inimical to good participatory research, the project will have to take express measures to reorient and, where necessary, actively retrain partners in the FPR process.

Specific Problems Which May Arise in Implementing a Farmer Participatory Research Approach

Problem 1: The risk of pursuing overly narrow research objectives

The cornerstone in building a successful farmer participatory research process is to ensure that the scientists' objectives are compatible with the farmers' concerns. If the research teams start from their own priorities rather than the farmers' or try to keep their interventions within neat disciplinary bounds, their eventual recommendations will almost certainly be at odds with the farmers' multi-faceted concerns for their livelihood and food security. An example of such overly constrained objectives was the project's original intention to focus exclusively on cereals yields. This has now been modified to encourage research aimed at increasing the productivity of the whole cereal-based system, which is very much more relevant to farmer concerns. The challenge now will be to maintain, in practice, this more systemic approach and to develop indicators which are able to capture the more subtle and dispersed changes which are likely to characterize natural resource-based improvements in the farming system.

Recommendations:

Consider applications for the small-grants program in light of the seriousness with which the researcher addresses farmer participation interests. Is the approach truly multidisciplinary? Have the researchers demonstrated an interest in FPR? What steps do they propose to strengthen their skills in this area?

Institute annual reviews of the participatory process. As part of the annual review of activities, attention should be addressed not only to scientific results but also to the process of farmer participatory research. Internationally recognized researchers with extensive experience in FPR could be invited to participate in order to suggest improvements and reinforce positive features of the process as it develops at ISRA.

Ensure quantitative and qualitative monitoring of project results. Project benefits are unlikely to show up in dramatic increases in any single indicator such as crop yields. Particular attention will be needed to identify all the benefits as perceived by the farmers' as well as to measure more easily quantifiable indicators established by outsiders. This will require a combination of quantitative and qualitative evaluations. Rapid Rural Appraisal may prove useful in looking, qualitatively, at systems interactions.

Problem 2: Reversing Attitudes Which are Inimical to Farmer Participatory Research

a. At ISRA: the problem of "normal professionalism". Chambers describes normal professionalism as "the concepts, values, methods and behavior dominant in a profession." In the scientific research profession, the normal is, at best, to ignore and, at worst, to denigrate indigenous knowledge systems. Dominant attitudes reinforce the idea that the scientist always knows more and therefore knows best. There are many researchers at ISRA who have moved beyond this insular attitude and there are many others whose thinking is still bound up in the often sexist, often elitist, and often ageist patterns of normal professional thinking. It is unrealistic to think that institutional norms will instantly change or that the entire research staff will overcome these attitudes and be prepared to collaborate with farmers in a participatory research process. The initial goal should be (1) to provide resources and encouragement to those who have such an orientation and (2) to provide opportunities for everybody to at least be exposed to participatory methods and then to develop their skills if they so choose?

b. Farmers' Expectations. Socialization of rural people in Senegal has led to a widespread expectation that outsiders can and will solve their problems. The arrival of an outsider often seems to instantly neutralize local creativity and capacity for self-help. While farmers themselves have a long tradition of indigenous research, they may not fully understand the scientist-assisted research process, especially since the outsider is seen as a solution-bearer rather than a research partner.

Recommendations: Concerted and sustained efforts will be needed to overcome these entrenched biases since much of the project's success depends on establishing a productive scientist/farmer relationship. A bad research process will lead to inappropriate technologies and

continued low rates of adoption. Among the measures to address the problem:

Joint Seminars on Participatory Research with ISRA researchers and representatives of farmer associations that will be involved as collaborators. These should invite local and international people who have practical experience to discuss both the principles and practical application of FPR. It may be useful to collaborate with PRAAP (see above) in organizing such seminars.

Joint Study Tours for ISRA research teams and the farmers who will participate in the research. These focused visits should go to places where collaborative relationships are well underway and should explore the practical mechanisms for making them work.

Short courses for ISRA research teams in participatory research methods. Practical courses including field studies should be offered in such methodologies as Rapid/Participatory Rural Appraisal that are oriented toward multi-disciplinary, participatory research.

Problem 3: ISRA Procedures and researcher interests

a. Bureaucratic Procedures. The heavy bureaucratic procedures which currently hamper researchers at ISRA will be even more harmful to those trying to conduct FPR since it requires more than the usual flexibility and adaptability. Researchers are obliged to follow farmers' schedules and to respond quickly to changing conditions. Spending more and longer time in villages may require special transportation and logistics arrangements.

b. Researcher Incentives. From the researchers' perspective, the farmer participatory approach with a natural resource orientation has certain disadvantages. First, farmer participation implies patient ... painstaking attention to process. Establishing rapport may be time consuming in the short run and may not begin to show benefits until the long run. Second, natural resources-based technologies are more likely to show marginal improvements in the long-term than the dramatic immediate gains which can sometimes be obtained from higher input innovations. And third, the multidisciplinary approach is less likely to yield scientific results that can be directly attributed to one researcher's work. While some researchers will find immense personal rewards in working directly with clients on applied and urgent problems, others will have difficulties reconciling this approach with the reward systems of their profession which are often oriented toward individual, controlled experiments with clearly demonstrated results. This may pose a particular dilemma for young scientists who are still working on their degrees.

Recommendations:

Procedures allowing for flexibility. The financial advisor helping ISRA to review their procedures should do so in light of the

exigencies of FPR and should ensure that flexibility and responsiveness are not sacrificed in attempts to enforce stricter accountability.

Sensitization of administrators and research leaders. Administrators as well as researchers should be invited to participate in FPR seminars so that they become more familiar with the approach and more sensitive to its needs.

Encourage two-track research. Senior scientists and the technical assistance team will need to be sensitive to researchers' professional concerns and the possible divergence between their personal agenda and FPR. Many researchers will want to (and should be encouraged to) maintain two tracks of activities. One would focus on disciplinary issues -- the upstream research which will eventually feed information into the work with farmers. The second would involve seeking immediate applications for knowledge as part of the farmer participatory research process.

Publications and Conferences. The technical assistance team should help researchers identify journals and conferences which are willing to accept interdisciplinary research results and which encourage such an approach.

Attention to FPR issues in selecting training programs. When researchers are sent abroad for advanced training, efforts should be made to find programs which, while providing rigorous disciplinary training, also address the issue of how to apply that knowledge to real, field level problems. Programs which merely reinforce normal professional biases should be avoided.

Problem 4: Marginalization of Women Farmers in the Research Process

While it seems evident that women farmers should be fully involved in any FPR activities, they often are not. This may be because researchers unwittingly turn their attentions to men or because research teams that include only men may have difficulties establishing a good rapport with village women even if they try. Since there are only seven women researchers among 115 at ISRA, with current staffing most teams will not include women.

As an example of the unintended bias which can result, one ongoing project invited only men to the initial meeting to discuss the research project and, not surprisingly, ended up with only men doing the experiments. Despite the fact that women are active farmers in the region, they were excluded from cereals research and instead targeted to participate in research on dry season gardening which, while relatively marginal in the scope of women's total production, is widely perceived as a "women's activity".

Recommendations: Several measures are needed both to increase women's participation on ISRA teams and to increase scientists' sensitivity to gender issues.

Train women at ISRA. Women at lower levels of the ISRA staff (technicians) should be sent for training that will enable them to return as full researchers. The benefits of this will not be felt for some time.

Hire women researchers on a contractual/consultant basis. In the meantime, researchers establishing teams to do FPR should be encouraged to hire women researchers on a contractual basis, either for the length of the project (preferred option) or as consultants to participate at critical junctures such as the initial studies and needs assessments. While this is a second-best alternative, it may be difficult given the socio-cultural environment in Senegal to find women who are highly trained and able to relocate or spend extended periods in the field as would be required by a long-term position.

Include gender issues in FPR seminars. FPR seminars for scientist and farmer researchers should include information on gender issues with practical suggestions for how to minimize gender bias in research.

Use the presence of capable women as a criteria for selecting partner organizations. In selecting partner organizations (such as farmer associations and NGOs), ISRA researchers should try to identify those that have strong women's representation.

Require accountability. Reports of research activities should address the question of how many women are participating in village level research activities (both farmers and scientists).

VII. POSSIBLE CONSTRAINTS TO FARMER ADOPTION OF NATURAL RESOURCES-BASED TECHNOLOGIES

The ultimate objective of this project is for farmers to adopt techniques and technologies that result in a more efficient and sustainable use of the natural resources at their disposal and thereby enable them to better assure their household food security. A number of considerations are likely to factor prominently in the individual's decision to adopt or not to adopt the technologies developed during the life of the project.

Possible Constraint #1: Labor.

Measures to improve natural resource management are often not capital intensive but they do tend to require significant investments of labor. Estimates suggest that these may range from a relatively modest 4 person-days to plant windbreaks on a hectare of land up to as many as 142 days of work to do contour ridges on the same hectare. The farmer's decision to invest his/her time in technologies expected to increased yields is likely to involve careful calculations. Among the salient issues:

Seasonal time constraints. In general, Senegalese farmers face more labor constraints during the rainy season and the harvest

period which follows shortly after than during the long dry season. (In areas where lowland rice is cultivated the seasonal peaks fall at different times.) However, within each period there are significant variations in work load with certain peak times (planting, weeding, and harvesting in particular) requiring both intense and long hours of work. In many homes the early rainy season work is considered particularly difficult because it coincides with the "hungry period" when farmers are poorly nourished. Thus, certain activities such as planting Acacia albida or live fences are likely to fall during more difficult times in the farmer's work calendar.

Gender issues in time use. Both men and women face long hours and intense work during the rainy season. Men's work, however, often drops off quite sharply once the harvest is in. This contrasts with the women's labor calendar which, while less intense after the agricultural season, continues with a host of household maintenance activities including water carrying, wood fetching, child care, and food preparation. While both men and women attempt to expand and diversify their income generating activities during the dry season, men are more likely to leave the village in search of alternate employment. Hence, men's absence from the village may prevent them from investing labor in improved resource management activities while for women the constraint is more likely to involve other more immediate demands on their time.

The opportunity cost of labor. While there may be some element of truth in the widespread perception that (especially) male farmers cross their arms and play a lot of cards during the long dry season, there is also plenty of evidence to suggest that farmers are engaged in numerous remunerative activities during these months. These include commerce, artisanal production (e.g. mats), service activities (e.g. construction of roofs and fences), and animal raising. A significant part of the revenues so earned go to assure the family food supply once the stocks of home-grown cereals are exhausted. In these circumstances, a farmer's decision to invest labor in improved technologies will be highly related to the opportunity cost of the time they require. That is, if s/he needs to spend four days building a windbreak or 11 days making compost, what else might s/he be doing on those days and what is lost by reducing those other activities?

Example: a farmer may be accustomed to leaving the village during a good portion of the dry season to earn money which he sends back to the family for food purchases. A family of ten which has a four-month food deficit will need to purchase something like 500 kg of cereals (costing 50-60,000 cfa) to cover their basic consumption requirements. A farmer who has off-farm dry season activities which permit him to earn this sum is unlikely to jeopardize this livelihood by investing significant amounts of time on composting or planting trees which are unlikely to result in yield increases sufficient to assure a year-round food supply. This is especially true given that the yield increases are possible outcomes for next year (or further in the future) while his off-farm work guarantees a

certain return for this year when the family is hungry. In contrast, a farmer who earns 500 cfa every 3 days from constructing "crinting" (bamboo fences) locally in the village may well be willing to give up a couple of days of this work in order to invest his labor in a technology which promises even marginal yield improvements.

Each farmer will evaluate the labor requirements of proposed technologies in terms of the expected outcome and the opportunity cost of labor available in the family. As such, different families even in a same village will make different decisions. There is at least limited evidence (Fall) to support the intuitively logical supposition that in degraded, low yielding areas, families engage in a greater number of off-farm activities and gain more from these activities than in more productive agricultural zones. (Fall compares villages in the savanna and sahelian zones.) These results suggest that it may be especially difficult to attract people to adopt labor-intensive, yield-improving technologies in the most degraded areas where the opportunity cost of labor during the dry season is higher. This disincentive will be further compounded by the risk factor: returns to labor are less certain in such marginal areas which are characterized by limited and variable rainfall. No matter how much compost you put on a field, the crops won't produce if it doesn't rain.

In general, in the wake of poor harvests (due to low rainfall, insect attacks, etc.) labor investments in such technologies are likely to diminish since people are more likely to devote their efforts to securing current food needs than to investing in future yield improvements.

Possible Constraint #2: Water

The water shortages discussed in this section refer not to rainfall, but rather to the availability of water from wells and ponds during the dry season. Certain NRM technologies will require water, whether to maintain tree seedlings and animals or to keep compost moist. Many villages have benefitted from water infrastructures which allay this problem but many others face serious water constraints. (An initial ISRA/IFPRI survey found that up to 2/3 of the villages surveyed in the peanut basin judged that they faced water problems, see Diagana et al.) In such cases, villagers will make either individual or collective decisions concerning the allocation of water. Some villages, for example, do not allow animals to be watered until all women have had time to draw the water they need for household use. Such water restrictions may also affect the time needed to implement technologies if farmers have to go further in search of water or wait for wells to recharge.

In such cases, there will be clear advantages to establishing complementary research and development activities in collaboration with NGOs who may be able to act on the immediate need to deepen an existing well or sink a new one.

Possible Constraint #3: Land and Tree Tenure Problems

In practice, tenure issues in rural Senegal are governed by a combination of official regulations and customary rules. The latter vary considerably by region and ethnic group. Land and trees are each covered by different sets of rules. This leads to considerable differences in the incentives (or disincentives) farmers perceive to invest in trees and the land. In certain cases where tenure security is considered shaky, farmers -- as well as largeholders seeking to lay claim to territories not traditionally theirs -- have purposely made improvements in the land. They hope that making visible investments will strengthen their claim since one of the explicit criteria governing the distribution of land within communaut s rurales is the capacity of the user to add value to ("mettre en valeur") the territories they hold. This leads to examples of people with relatively insecure holdings planting trees or hedges around their fields (Hardy-Golan).

In yet other cases, however, uncertain claims to land clearly acts as a disincentive to investments. In parts of the peanut basin where individual farmer's fields have become ever smaller (due to dividing fixed sized inheritances into smaller parcels with each generation), many farmers cultivate "borrowed" lands (Dugué). Such borrowing arrangements usually last for one year only, in part to ensure that the lendee does not develop any lasting claims. Hence, farmers report that since the benefits of "parking" animal herds which manure the fields during the rainy season last up to three years, and the benefits of dry season parking or spreading manure last two years, they would not consider using manure on borrowed land. Even less would they spend time planting or protecting trees on such lands (personal communication: Thomas Faye, farmer in Lambokh).

Where farmers are making improvements to their own long-held, individually (or family) cultivated fields, few tenure problems are likely to arise. Rights to such areas are usually clear and well established, whether through formal or customary procedures. Conflicts are much more likely where:

(1) land use patterns are changing over time

A low value piece of land may be relinquished by its traditional user and taken over by another individual or group (as when a chief "grants" part of his extended fields to the village women's group for a garden). When such lands are improved (with tree planting, water harvesting measures, etc.) the original owner may reclaim his rights and attempt to dispossess the individual(s) who invested in the improvements (personal communication: Amadou Diop, Rodale, and also see Carney for examples from The Gambia).

(2) improvements are on "public" or common lands with multiple users

This may be the case where a village decides to "manage" a pasture area or community forest which was used by more than the immediate inhabitants of the village. Management in many cases implies exclusion or control of resources which is likely to benefit some groups at the expense of others. Conflicts frequently arise. For example, "mise en defense" (fencing or otherwise restricting access to an area in order to encourage regeneration) often excludes pastoralist populations who may have had traditional rights to seasonal pasturage and browse.

(3) the area under consideration is only recently settled

This includes newly established villages or recently settled areas such as the "Terres Neuves" where customary practices may not be fully established. Such areas are likely to be subject to competing claims since even territories which appear to outsiders to be little used are almost always exploited by somebody. Land which increases in value as a result of human investment is more likely to be the subject of dispute when customary law is only weakly in force.

To add to the complexity, tree tenure follows a different set of rules and customs and, officially, is regulated by the forest code. Here again, local customs vary considerably as does the zeal with which forest code regulations are applied in practice.

Example: The case of a ronier palm tree in the upper Casamance illustrates the kinds of conflicting claims and incentives which can arise. From an official perspective the rules are clear: all such roniers are the property of the state and can only be cut with permission of the forestry service. Customary rights, however, vary by ethnic group. The Peul tradition in the area considers that roniers belong to the person on whose field they stand; the farmer has the right to cut the tree and harvest its branches as he wishes. For Diolas the tree belongs neither to the state nor to the present proprietor of the land, but rather to the original owner of the territory. Thus, in cases where Diola villages have moved and no longer lay claim the land, they still consider themselves the owners of the ronier trees they left behind perhaps a generation or more ago. Current "owners" of the land are expected to seek authorization from the original proprietors if they wish to harvest or cut a ronier tree (RRA: Faraba).

Clearly, a farmers' decisions to plant, protect, harvest the products of, or fell a tree all depend on their perception of who controls or will control access to the benefits. The current forest code stipulates, among other provisions, that the cutting or mutilation of any tree planted by man as well as all "exotic" and some 18 species of local trees (including Acacia albida) must be approved by the forest service even if that tree is on a farmer's individual field. When it comes to harvesting the products of the same trees, the forest services applies wide discretionary and not always consistent powers. Many observers feel that the current code is a disincentive to farmers' rational management of their resources. Currently, "the state is claiming certain use rights over tree resources planted or tended by individual farmers. This

affects the ability of farmers to predict with confidence their returns to investment in forestry and agroforestry (Elbow and Lawry)." A new code is under consideration which will, if approved, at least partly allay some of the more restrictive and counterproductive regulations. Questions remain concerning how far it will go in permitting farmers freely to determine how trees they plant will be exploited (Elbow and Lawry).

Possible Constraint #4: Skewed resource endowments (especially capital and animals)

The project's emphasis on increasing well-being through improved management of natural resources is likely to extend benefits to a larger population than if efforts were consecrated to technologies dependent on purchased inputs. There are, nevertheless, equity concerns. Some farmers will have more of certain inputs, whether the animals needed to produce manure or the capital needed to invest in better equipment or machinery; the participation of some people will undoubtedly be limited by their poverty.

Since women, in general, possess fewer large animals (cattle, horses) which are important for manure and animal traction, there may be a concern that they will be in large part excluded from the benefits of manure-based innovations. In fact, however, the equity implications are less serious than one might initially expect. Women may indeed be constrained from directly adopting manure-using technologies. However, since men farmers have shown a strong preference for using manure on the family cereal plots (Gaye), any yield improvements are likely to accrue to the family as a whole. The ownership of the field which is favored and whose labor and manure is used in production is thus less important from a gender perspective than the fact that its product is destined for family consumption. This is why it is particularly important to note that in Senegal the commonly described pattern of men cultivating cash crops and women cultivating food crops does not generally apply.

More serious than intra-family disparities are differences in cattle ownership between families. Since cattle are a principal form of savings, wealthier rural families are far more likely to possess herds than poorer ones. In many villages there are traditional systems of exchange which have enabled the benefits of manure to be redistributed from cattle owners to non-owners. After parking his animals on his own cereals fields, the owner may for "the price of kola" (a token fee) move the animals to other fields in the village. If the recognized value of manure increases as a result of project activities, it may become less readily available or more expensive to non-cattle owners who are generally poorer people.

Possible Constraint #5: Need for leadership / organization / political mobilization

Like most other development interventions, the ability of villages and individuals to capture the full potential of natural resources-based technological improvements will depend on the

strength of local leadership and community organization. Some innovations can be adopted by forward looking individuals; others will depend on the community's collective capacity to manage their space, resolve disputes, and persuade local authorities to respond to their needs. Until (and perhaps after) the forest code is passed, there is considerable government authority over the use of local resources and improved management practices require various permits and authorizations. In some cases these will be granted without difficulty, in others considerable political pressure may be called for. Villages which are less well organized and more distant from administrative centers are at a disadvantage in this process.

Observations and recommendations concerning these constraints:

Two overarching recommendations are relevant to all the issues raised above.

(1) the more genuinely participatory is the research process, the less likely that these issues will pose serious problems.

Collegial participation implies communication, attention to all issues which are likely to affect farmer adoption, and maximum efforts to meet needs and adapt to constraints. When labor patterns are explicitly and carefully discussed between farmers and scientists, technologies can be adapted to ensure that they do not add to the labor burden during peak periods. When information is shared about traditional tenure arrangements and manuring systems, improved measures can build on existing knowledge and practices rather than undermining them. Problems are most likely to arise when the issues are ignored or the farmers' knowledge and concerns are not adequately heard and incorporated into the research process.

(2) it is critical that the emphasis be on presenting farmers with "baskets of choices" rather than narrow technical recommendations.

The smörgasbord permits users to adopt technologies based on their individual needs and conditions. What makes sense for a farmer with five cows and no outside employment may make no sense at all for a farmer who earns dry season income as an itinerant commerant and has no cattle. A farmer with large fields and few sons will make different technological choices from one with small fields and an ample labor supply. The options should build on and exploit the diversity of farmers' strategies rather than vainly expecting to standardize them.

In addition:

(1) working through farmers' associations can help to overcome some of the organizational inertia which arise and mobilize collective influence to protect individual farmers' rights.
An association may be able to persuade authorities who commonly turn a deaf ear to pleas of individuals to authorize certain actions and to reduce bureaucratic impediments to local resource management.

(4) Tenure problems should be carefully documented and ISRA social science researchers should be encouraged systematically to include these issues in their analysis.

If necessary, short courses addressing tenure issues could be offered. Since similar problems are being addressed in the ongoing USAID forestry project, it may be worthwhile to hold a joint seminar on tenure issues in resource management and to develop recommendations for how national policy can best respond to local NRM concerns.

VIII. WINNERS AND LOSERS

Potential Winners

The potential winners in this project are many. The surest and most immediate winners are the researchers and staff at ISRA and their U.S. counterparts who will gain access to research and operating funds as well as expanded opportunities for long and short-term studies. The number of people affected is likely to be in the hundreds. The actual numbers and kinds of people benefitting at this level will depend, among other factors, on:

-- the efficiency of the management systems which are put into place to manage project funds,
-- the fairness of systems established to choose participants for training, workshops, and research grants,
-- the interest of individuals in participating in the kind of participatory research encouraged by the project.

The next rounds of benefits become increasingly dispersed, more marginal, more risky, and more remote in time. The second most immediate group of beneficiaries will include the associations and farmers with whom ISRA researchers work directly. The numbers of people in this group will probably also be in the hundreds. These people will benefit from certain travel opportunities and project inputs (e.g. seeds, technical advice, etc.) needed to conduct on-farm research. They should also gain from improvements in yields and enhance their own ability to conduct and judge research. There is likely to be some rather immediate spillover benefits from this group to neighbors and proximate villages. This will extend benefits in the second round to several thousands of people. The numbers and kinds of people affected in this round and the significance of the benefits they receive will depend on:

-- the commitment of researchers to carrying out genuine and collegial participatory research,
-- the effectiveness of training programs, workshops, and study tours introducing scientist and farmer researchers to the principles and practice of FPR,
-- the establishment of administrative structures at ISRA which can be responsive to FPR exigencies.

The third round of benefits will accrue to farmers who do not interact directly with ISRA researchers but learn of the improved technologies indirectly, experiment with the techniques and, eventually, adopt those that are suited to their needs. The number of potential "adopters" is bounded by the number of farmers in the 400mm plus rainfall zone (several million). At least in the short and medium term, however, the actual number of beneficiaries at this level is likely to be only a small fraction of the potential number due to the many conditions that must be met in order for farmers to receive benefits. Constraints exist at the level of the individuals involved, the institutions, the national policy level, and above. Adoption rates will depend on all the factors cited in the second round above, as well as:

-- whether a range of improved resource management techniques with clear benefits to the farmer is actually developed,
-- the effectiveness of farmer associations, as well as other formal and informal communications networks, in disseminating information,
-- whether complementary development activities needed to exploit improved technologies are put in place by partners (wells, credit programs, etc.),
-- whether government policies are changed in order to facilitate improved use of natural resources at the local level (e.g. revision of forest code),
-- rainfall and other exogenous factors (locusts, civil unrest) affecting harvests and hence farmers' ability to invest in future improvements rather than current food supplies.

The fourth round of potential beneficiaries is broad indeed, extending not only to the rural adopters of improved technologies but to all who benefit from increased food production as a result of more efficient use of the nation's resources. These include the urban relatives of farmers who will be less burdened in providing for food-deficit cousins as well as urban consumers of cereals and forest products.

Potential Losers

Natural Resource Management Projects in general and this one in particular often orient their actions toward sedentary populations and focus their attentions on crops-based farming systems (Painter). In Senegal this approach is relevant for the majority of rural families. There is nevertheless, a minority population which, while they may cultivate small parcels of crops during the rainy season, depend for most of their livelihood on animal raising and herding. Most of this population belongs to the Peul ethnic group and are semi-nomadic. (It should be noted that many other Peul are sedentary cultivators who may or may not herd cattle. This larger group stands to benefit in the same way as other sedentary farmers.)

The Peul transhumance routes frequently take them to the peanut basin and further north during the dry season as they seek pastures

and watering points for their animals. In the past, these populations maintained highly synergistic relationships with cultivators, exchanging manure for pasture stubble, and milk for cereals. Some of these relationships continue but in general the pattern has been toward less specialization; increasingly, cultivators keep their own animals and herders cultivate larger parcels of crops. In some cases the cattle kept by Peul herders belong not to them but to other farmers and even urban dwellers who confer animals to their care.

When projects target the cultivators and do not consider the transhumance people who use the space on a temporal basis, pastoralists' concerns are often overlooked. The same concern applies to other occasional or temporal users which may include fisherman and groups whose livelihood is particularly oriented toward collection of forest products. As noted above, "management" in such projects often implies exclusion of outsiders or restraints on their activities whereas more traditional systems allowed for overlapping use rights by a variety of not necessarily permanent users. Fences and bunds may hinder the passage of animal herds. Villagers may set up self-sufficient systems of resource management such as composting their crop stubble to put back on their own fields rather than maintaining complementary relations with herders which may have had important advantages for the latter.

While the numbers of people affected is likely to be small, the impact on the losers may be significant. Some of the negative effects can be avoided if social scientists take special pains to identify the multiple users of common property resources and especially those who are more invisible because they are not full-time residents of the community. Once recognized, their concerns can be incorporated into research on improved natural resources-based technologies and techniques.

PROCUREMENT PLAN FOR COMMODITIES AND SERVICES

Introduction

Procurement needs of the Natural Resources Based Agricultural Research project can be divided into four areas: (1) the procurement of services (a) from local sources for a "technology inventory"; (b) of a U.S. university/private consulting firm consortium for the provision of technical assistance to ISRA; (c) procurement of evaluation and audit services; (d) procurement of financial management and audit services from a local accounting firm; and e) pre-implementation workshop/seminar; (2) procurement of household furniture and an initial set of vehicles and equipment for the technical assistance team directly by USAID (including possible procurement of warehouse services for a limited period of time); (3) procurement of replacement vehicles beginning in year 4 of the project; and (4) specific agricultural research support equipment and materiel specifications for which will be determined by ISRA and the technical asssitance team.

Procurement of Services:

Upon signature of the Project Grant Agreement with the Government of Senegal (GOS) and completion of the conditions precedent to initial disbursement, USAID will issue a PIO/T requesting that the Regional Contracting Officer in REDSO/Abidjan assist with the preparation of a Request for Proposal (RFP) from the U.S. university community for a direct AID contract in accordance with AID Regulations. The availability of the RFP will be advertised in the Commerce Business Daily. The RFP will specifically state that each University must submit a joint proposal with a U.S. consulting firm and/or a private voluntary organization or both. The background, terms of reference, and qualifications for individual team members will be jointly developed between USAID/Dakar and ISRA. Appropriate weights will be assigned and ISRA will join USAID in the contractor selection process as a member of the selection team.

Procurement of Commodities

While developing the RFP and awaiting the contractor selection process, USAID will directly procure necessary household furniture and appliances for the five member long-term technical assistance team. Vehicles, office equipment and furnishing will be ordered directly by USAID from the United States. Procurement will begin upon signature of a Project Implementation Order/Commodities (PIO/C) after the GOS has met the conditions precedent to first disbursement so that the equipment, commodities, and vehicles are available for the technical assistance team pursuant to the schedule developed for their arrival.

Upon the arrival of the technical assistance team and upon approval of the first annual workplan and budget, ISRA and the TA team will specify additional commodity requirements and begin procurement of this materiel. The contractor chief of party (or his/her designee) will procure all additionally required commodities, office equipment or supplies including replacement vehicles the procurement of which will begin in year four of the project. The contract chief of party, his staff and ISRA scientists will develop this complete list of planned procurement for review by the USAID/Dakar Mission. Approval of USAID is required before any procurement may begin.

Development Fund for Africa Procurement Implications

The project is funded through the Development Fund for Africa (DFA), which provides a special waiver to the Foreign Assistance Act of 1961 pertaining to U.S. source and origin rules for goods and services procurement. Specifically, the authorized Geographic Code with respect to source, origin, and nationality for procurement under DFA is up to A.I.D. Geographic Code 935, defined as Special Free World, including the participating country. The purpose of the waiver is to ease existing procurement procedures, which were seen as impeding project implementation in Africa. Although Geographic Code 935 countries are authorized, the DFA-funded projects still must have a DFA procurement plan which shows an order of preference of U.S. source and origin and then Code 941 source/origin to the fullest extent possible. The special waiver also directs African field posts to formulate comprehensive procurement plans which assure U.S. purchases whenever practicable, consistent with program objectives.

The project will be responsible for assuring that the sub-project proposals include source and origin information on all commodity procurement and that order of preference is documented in the project review documents. Sub-grant purchases of commodities from Code 935 sources, such as vehicles from France or Japan because of availability of spare parts and service, do not require a separate A.I.D. waiver as long as the project documents the rationale for the order of preference. All other procurement regulations shown in A.I.D. Handbooks 1B , 11, and 14 remain unchanged.

251

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Village/Department	Topic	Date
Louly Mba Faye (Mbour)	Post-Production Systems	2/10-6/10/89
Samkedji (Mbour)	Food Security	29/11-03/12/89
Ndine (Thies)	Water Resources	6/5-10/5/90
Linkering (Velingara)	Integrated Rural Devt.	21/11-28/11/90
Guiro Yoro Alpha (Kolda)	Integrated Rural Devt.	3/12-6/12/90
Toulde Gaale (Podor)	Integrated Rural Devt.	11/12-16/12/90
Diolla (Matam)	Integrated Rural Devt.	18/12-21/12/90
Sinthiou Boubou (Bakel)	Integrated Rural Devt.	3/1-6/1/91
Faraba (Sedhiou)	Agricultural Prodn.	25/4-1/5/91

IEE ENVIRONMENTAL EXAMINATION OR CATEGORICAL EXCLUSION

Annex 2-1

Project Country: Senegal

Project Title: The Natural Resources-Based Agricultural Research Project (685-0285)

Funding: FY 91-96, $26 million

IEE Prepared by: Dean Myers, Chief, Project Development office.

Environmental Action Recommended:

Positive Determination X

Negative Determination _____

Categorical Exclusion:

The project falls within the class of actions designated as suitable for categorical exclusion under Sections 216.2 (1) (iii) concerning research activities that may have an effect on the physical and natural environment but will not have a significant effect as a result of limited scope, carefully controlled nature and effective monitoring.

Legal Concurrence:

Pursuant to AID/W guidance in State 365643, para 11, this IEE has been reviewed for clearance by the Mission Legal Advisor. It has also been cleared by the Mission Environmental Officer.

RLA: AAdams _____

Concurrence:

USAID/Senegal EO: GHaycock _____

Concurrence:

Bureau Environmental Officer _____

Clearance GC/AFR _____

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256

Project Description: The Natural Resources Based Agriculture Research Project (685-0285) will generate improved and sustainable soil and water management technology to increase agricultural productivity in zones of reliable rainfall. The project will help Senegal's Agricultural Research Institute (ISRA) to reorient and reinvigorate its soil-water management program. It will also improve ISRA's ability to do on-farm research through links with NGOs and farmers' organizations. Finally, it will improve the quality of research and research personnel through intensive training and collaborative work with international research institutions.

The goal of the project is to increase crop productivity in zones of reliable rainfall. The project responds directly to two of the government's highest priorities -- improved natural resources management and increased productivity for cereal crops.

The project's purpose is to generate technologies based on improved natural resources management practices which increase the productivity and sustainability of cereals-based cropping systems. Outputs include (a) an effective, adaptive research program focusing on cropping systems and resource management, i.e., soils and water management, forestry and agroforestry and improved cultural practices for primarily millet, sorghum, corn and rice; (b) development of technical approaches, tested on-farm and validated for economic potential and promise for real increases in productivity; (c) farmers adopting developed approaches; (d) development of strong research-extension cooperation in adaptive research and transfer of adapted technologies to the field as well as increased feedback from farmers to ISRA on research results and from ISRA to farmers on appropriate and sustainable technologies; (e) improved linkage to international and domestic institutions; (f) ISRA's improved research planning, financial and manpower management. Project's inputs include technical assistance, training, commodities and equipment, research grants to PVOs, farmer organizations, input suppliers, domestic research institutions, and to ISRA staff on a competitive basis; network participation; natural resources management research program. There will be no financing of any construction under the project.

Technical assistance will be provided to ISRA in natural resources management including agronomy, soil conservation and fertility, agroforestry, extension, and research, manpower and financial management. The emphasis of the project is on developing sustainable soil, water and agroforestry technologies for regenerative environment and enhanced agricultural productivity -- the use of vegetative and animal fertilizers, trees and other vegetative covers for increasing soil fertility and protection and water harvesting. Any use of chemical fertilizers, or pesticides will be in small, carefully controlled research activities. The commodities component of the project does not provide funding for purchase of fertilizers or pesticides.

Recommended Environmental Action:

Negative Determination: The project is within the class of actions designated as suitable for categorical exclusions, and, therefore, no

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Further procedures are required under the A.I.D. Environmental Procedures as per:

"Section 216.2 (c) (1) (iii): research activities which may have an affect on the physical and natural environment but will not have a significant effect as a result of limited scope, carefully controlled nature and effective monitoring."

The affect and impact on the environment of the research, technologies and farm trials carried out under the Project are expected to be positive. Negative impacts are not anticipated and all impacts will be closely monitored.

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ACTION: AID INFO: EXEC ECON RIG

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LOC: 279 546
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CN: 46234
CHRG: AID
DIST: AID

Date Rec'd 13 JUN 1991
MDM .....
Action Taken .....
Date .....
Signature .....

AIDAC

E.O. 12356: N/A
SUBJECT: IEE FOR NATURAL RESOURCES-BASED AGRICULTURE RESEARCH PROJECT (685-0285)

SUBJECT IEE WAS CLEARED BY GC/AFR AND SIGNED BY BUREAU ENVIRONMENTAL OFFICER. COPY WILL BE POUCHED. BAKER
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259

SCOPES OF WORK FOR TECHNICAL ASSISTANCE

1. Chief of Party/Research Manager

Objective: The objective of the Chief of Party/research manager is to assist ISRA's Director-General in all aspects of the management of ISRA as an institution -personnel, financial, administrative and scientific - and to assist the NRBAR project achieve its intended purpose. The COP will work closely with the ISRA Director General for overall coordination and support of the project and for overall technical input into planning and operations of the NRBAR. The COP will also be expected to have experience with agricultural research management or planning in developing countries. The Chief of Party (COP) will also assume primary responsibility for day to day administration of the technical assistance contract team. The COP's USAID counterpart will be the USAID Project Officer for the NRBAR project. U.S. backstopping support for the COP will be provided by the campus Project Director or the contractor's home office designated Project Leader. The COP will have one local hire full-time administrative officer to assist with day to day operations of a purely administrative nature.

The following duties and responsibilities are indicative of the responsibilities anticipated. They are illustrative only and the duties are not necessarily limited to these:

1. Meet regularly with ISRA and USAID, and with other TA team members, to develop annual and multi-year plans and objectives. Submit these documents in a timely manner for ISRA and USAID approval. Meet with these and other persons within USAID, or within the interested donor community, to assess ISRA's progress in NRM-related research planning, management, and technology generation.

2. Submit project documentation for project implementation actions and submit these documents to ISRA and USAID for approval and action. Assure that these documents are consistent with prior approved annual workplans and budgets or other programmatic documentation.

3. Plan the development of a Natural Resources Management Advisory team, linking U. S. researchers with ISRA scientists to exchange visits twice annually and to develop joint research protocols on various aspects of the NRBAR research agenda. In this regard, the COP will also meet with visiting international researchers, and other donors groups to develop a justifiable networking program for exchange visits between ISRA and international research centers and project sites where NRM-related agricultural research work is being carried out.

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4. Assist with periodic project implementation review meetings.

5. Assure that participant training programs are developed, trainees identified and placed, and follow-up of academic work is done.

6. Prepare and submit detailed quarterly project implementation or progress reports to ISRA and to the USAID Mission.

7. Participate, as required, in the development of the scope of work for the mid-term project evaluation.

8. Participate actively in all aspects of project implementation and review through site visits, donor coordination meetings and periodic meetings with MRDH officials.

9. Serve as a member of the committee to review collaborative research contracts and the sabbatical leave program.

10. Submit quarterly contract operations report representing the technical assistance team's progress for the quarter.

Qualifications: The COP must have 10 years or more of progressively responsible positions within agricultural research institutions. The acceptable candidate will have a PhD in agricultural science. Prior experience working with developing country agricultural research institutions is required. Strong administrative skills and prior experience as a team leader, preferably on a USAID-funded project, are highly desireable additional qualifications. French speaking at the FSI equivalent of S3R3 is required.

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II. Natural Resources Research Planner

Objective: The objective of the Research Planner is to assist ISRA's various departments in planning, conducting and evaluating natural resources based agricultural research. The Research Planner will work under the overall direction of the Contract Chief of Party and directly with ISRA's Director of Scientific Research (or his designee). The research planner is to provide technical guidance to ISRA's staff engaged in carrying out core natural resources research. The planner should seek means of encouraging farmer-oriented and farmer participatory research work and inter-disciplinary approaches to research planning, execution, and evaluation. The research planner should have 10 or more years of progressively responsible positions within research organizations preferably with U.S. land grant institutions.

The following duties are illustrative of the responsibilities of the research planner:

1. As requested by ISRA, organize meetings among researchers at the departmental level and program level, identify priorities for research programs, evaluate research progress on a bi-annual basis, ensure the gathering of socio-economic data for measurement of impact (as appropriate), and seek to identify and implement means of improving efficiency within ISRA's research programs.

2. Organize monthly meetings on research planning and budgeting. As requested by ISRA, develop the scopes of work for specific subject matter short term technical assistance in the field of research planning.

3. Work with ISRA researchers to develop the sabbatical grant proposals (the identification of a problem and an international collaborator), evaluate the report of the sabbatical, and make recommendations to ISRA, USAID and the technical assistance chief of party on means of improving this aspect of the NRDAR program.

4. Work with research station directors and their staff on means of reducing costs of research and experimentation at the station and on-farm levels. The results of this work should be presented in workshops and seminars at various levels within ISRA.

5. Identify studies which should be undertaken to respond to questions faced by ISRA as a research institute.

6. Maintain contact with technical staff of other donor agencies represented in Senegal and participating IARCs and regional institutions as appropriate.

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7. Assist TSRA plan annual scientific program reviews including assistance with the editing of papers and reports for these meetings.

8. Assist TSRA scientists to continue to develop additional inter-disciplinary, farmer-oriented research program approaches to adaptive research .

9. Participate, as requested in the collaborative research contract program, either in the development of the proposal(s) or in the review and selection of final contracts.

10 Assist with the identification of training needs and with the identification of appropriate long and short-term training programs to meet those needs.

Qualifications:

The research planner should have a PhD in agricultural sciences plus ten years of increasingly responsible positions within an agricultural research organization. The successful candidate should be well published in reputed scientific journals, have experience with writing scientific grant proposals, and experience supervising graduate students. Experience in planning and managing research in an African institution would be a valuable asset. French speaking capability should be at least S3R3.

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III. Agricultural Research Outreach Coordinator

Objective: The objective of the agricultural outreach coordinator is to ensure that clients of agricultural research (farmers groups, NGO's, parastatals, private sector) have access to appropriate and adapted natural resources based agricultural technology. The outreach coordinator will work within ISRA's UNIVAL (Unite de Valorisation) and directly with client groups to define, articulate, and assist them to contract for specific agricultural research responsive to the needs of the client group. The coordinator will be responsible for establishing a system for administering, financing, and monitoring of performance based collaborative research contracts among client groups and ISRA. The coordinator will spend at least 50% of his time in the field advising and assisting the project with the collaborative research contract program. The coordinator will receive overall direction from the COP and will work closely with ISRA station directors and their staff, and NGO organizations and other client groups in the conduct of this program.

The following duties are illustrative of the responsibilities of the Agricultural research outreach coordinator.

1. Establish strong productive, professional relationships with ISRA's UNIVAL, extension agency staff and farmer groups, NGO's, and private and parastatal organizations (the "clients") involved in agricultural development in the prooject zone.

2. Review the inventory of available technology and work with clients to define their research requirements in a performance-based contract proposal which can be carried out under this project.

3. Assist in the refinement of collaborative research contract proposals, attend review meetings, and review financial and technical requirements of each proposal.

4. Work with UNIVAL staff and the clients to measure the impact of the research work contracted under the project.

5. Meet bi-annually with ISRA scientists and extension staff and representatives of client organizations to review progess and plan future activities and modifications to the collaborative research contract process.

6. Work with appropriate organizations to assure the transfer of technology to the clients.

Qualifications: The outreach coordinator must hold an advanced degree in one or more natural resource management related fields (agronomy, tropical forestry, soil science, etc). The coordinator must have five or more years with agricultural extension-related activities in developing countries. Prior experience in West Africa would be useful but not essential. The successful candidate must be able to demonstrate administrative and scientific skills as well as strong inter-personal and communication skills. French language speaking and reading at the FSI rated S3R3 is required.

265

IV. Financial Management Advisor

Objective: The objective of the Financial Management Advisor is to support ISRA to strengthen overall management and administration of GOS, ISRA and other donor financial resources. The Financial Management Advisor must assist ISRA as an institution in the development of responsive, and improved management, budget control, and accounting systems for ISRA headquarters and ISRA field stations nationwide. The Financial Management Advisor will work under the overall direction of the COP and directly with the Secretary-General of ISRA or his designee. The Financial Management Advisor will also assist with the financial management, control and reporting of the USAID project funds on behalf of the contract technical assistance team.

The following duties are examples of the responsibilities of the Financial Management Advisor.

1. Review ISRA's current and proposed financial management systems. Analyse automated data processing systems and make recommendations for refinements of improvements to the system.

2. Analyse ISRA's financial staff skills, requirements, and training needs. Propose a staff training program (for ISRA headquarters as well as station level personnel) designed to overcome any weaknesses identified.

3. Analyse the interaction among headquarter and field station systems and propose modifications to the system to improve timeliness, responsiveness and control over resources.

4. Review ISRA's system for financial management with that of various other donors and propose means of coordinating or standardizing accounting and control systems for maximum efficiency.

5. Develop systems manuals for headquarters and field staff and develop training programs which may be required to instruct staff on the use of new procedures.

6. For the USAID NRBAR project, participate in the development of an operations manual and propose for USAID's review and approval adequate accounting systems and solid financial controls for the project's local currency expenditures.

7. Review financial aspects of financial implementation documents such as workplans, collaborative contracts, and protocols, and propose, for USAID review and approval, adequate financial control mechanisms for these implementation actions.

8. Review and approve the contract technical assistance team periodic financial reports issued to USAID and participate in the drafting of the financial aspects of the project quarterly operations report.

9. Prior to the signing of collaborative research contracts, review the financial terms of the contract for the collaborative research committee's review and approval.

10. Assume responsibility for the implementation of any recommmendations made during periodic financial compliance audits and or non-federal audits.

11. Prior to USAID's approval of the assumption of any in-direct costs, the financial management advisor should determine the basis and the accuracy of the indirect cost calculation.

Qualifications: The Financial Management Advisor must be a U.S. certified public account or equivalent (expert comptable). He/She should have a strong automated data processing background and ten years of experience in financial management and analysis. A strong background in accounting systems is required. Familiarity with French accounting, budget and financial manageament principles and systems is required. French speaking ability at the FSI equivalent of S3R3 is required.

ANNEX L

I. SUMMARY PRE-IMPLEMENTATION PLAN (MONTH 0-12)

OBJECTIVE AND ACTIONS	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7	MONTH 8	MONTH 9	MONTH 10	MONTH 11	MONTH 12
1. PP APPROVAL												
2. PROJECT AUTHORIZED WAIVERS												
3. PROJECT AGREEMENT												
4. C.P MET												
5. PRE-IMPLEMENTATION WORKSHOP												
6. PRE-PROJECT ACTIVITIES												
7. REQUEST FOR PROPOSAL												
8. CBD NOTICE												
9. BIDDERS CONFERENCE												
10. FIRM AND T.A. SELECTION												
11. CONTRACT NEGOTIATION												

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PRE-IMPLEMENTATION PLAN (MONTH 0-12)

I.A PARTICIPANTS TRAINING

OBJECTIVE AND ACTIONS	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7	MONTH 8	MONTH 9	MONTH 10	MONTH 11	MONTH 12
ISRA PROPOSAL												
SELECTION PROCESS BY A UNIVERSITY TDY												
PARTICIPANTS ACCEPTED IN DIFFERENT UNIVERSITIES												
DRAFT PIO/PS												
MISSION CLEARANCE												
ISRA'S SIGNATURE												
SELECTION OF ENGLISH LANGUAGE SCHOOL												
CANDIDATES BEGIN ENGLISH LANGUAGE												
CANDIDATES TERMINATE ENGLISH LANGUAGE												
PARTICIPANT PREPARATION (PASSPORT, MEDICAL CERTIFICATE)												
PARTICIPANTS DEPARTURE TO COMPLETE ENGLISH LANGUAGE												

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PRE-IMPLEMENTATION PLAN (MONTH 0-12)

I.B TECHNICAL ASSISTANCE

OBJECTIVE AND ACTIONS	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7	MONTH 8	MONTH 9	MONTH 10	MONTH 11	MONTH 12
a) FINANCIAL STUDY												
- Draft Sow for Financial Management Services												
- Approve PIO/T												
- Advertise for Services												
- Select Contractor												
- Financial Mgt Team begins												
b) TECHNOLOGY INVENTORY												
- Draft SOW for Technical Inventory												
- Approve PIO/T												
- Advertise for Services												
- Technology Inventory												
c) CBD NOTICE AND RFP												
- Draft Cable												
- Approve Cable												
- Draft RFP												
- Approval RFP												
- CBD Notice												
- Prequalification Firms												
- Invitation for Bid Issues												
- Awarding of BID												

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271

PRE-IMPLEMENTATION PLAN (MONTH 0-12)

I.C COMMODITIES PROCUREMENT

OBJECTIVE AND ACTIONS	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7	MONTH 8	MONTH 9	MONTH 10	MONTH 11	MONTH 12
PIO/C VEHICLES (Local Procurement)												
PIO/C OFFSHORE PROCUREMENT (Household furniture, Aplliances, Office equip.)												
COMPETITIVE SELECTION FOR VEHICLES												
COMPETITIVE SELECTION FOR OFFSHORE PROCUREMENT												
VEHICLES ARRIVAL IN FIELD												
OFFSHORE PROCUREMENT ARRIVAL												

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PROJECT START-UP (MONTH 13-24)

OBJECTIVE AND ACTIONS	MONTH 13	MONTH 14	MONTH 15	MONTH 16	MONTH 17	MONTH 18	MONTH 19	MONTH 20	MONTH 21	MONTH 22	MONTH 23	MONTH 24
CONTRACT SIGNATURE												
PARTICIPANT DEPARTURE TO THE US												
TA MOBILIZATION AND												
TA ARRIVAL IN COUNTRY												
REVIEW ISRA PREVIOUS FINANCIAL/BUDGET MANAGEMENT												
DEVELOP AN OPERATION MANUAL												
DEVELOP AN ANNUAL FINANCIAL AND WORKPLAN												
DEVELOP CONTACTS WITH APPROPRIATE NGO'S AND PRIVATE ORGANIZATIONS												
ARRIVAL OF INITIAL COMMODITIES PROCUREMENT												
SUBMISSION OF FIRST QUARTERLY REPORT												
DETERMINATION WITH ISRA PROJECT COMMODITY REQUIREMENTS												

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PROJECT IMPLEMENTATION (MONTH 25-36)

OBJECTIVE AND ACTIONS	MONTH 25	MONTH 26	MONTH 27	MONTH 28	MONTH 29	MONTH 30	MONTH 31	MONTH 32	MONTH 33	MONTH 34	MONTH 35	MONTH 36	ETC
ANNUAL RESEARCH PLAN													
PARTICIPANT SELECTION PROCESS													
NEGOTIATE AGREEMENTS AND PROTOCOLS FOR GRANTS TO FARMER GROUPS													
ASSIST ISRA TO DEVELOP SELECTION CRITERIA FOR DIRECTED GRANTS													
OBSERVATION TRIPS FOR ISRA RESEARCH SCIENTISTS													
HOST COUNTRY CONTRIBUTION LOCAL CURRENCY FROM AG. SECTOR PROGRAM													
MID-TERM EVALUATION													

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PROJECT PHASE DOWN (LAST 6 MONTHS)

OBJECTIVE AND ACTIONS	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6
Final Evaluation						
Non Federal Audit						
Commodities Inventory Review						
Transfer of Commodities						
Contractor Report						
Project Completion Report						
Project Executive Summary						
Terminal Disbursements Date (9 months after the PACD)						

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