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CLASSIFICATION

PROJECT EVALUATION SUMMARY (PES) -- PART I

Report Symbol U-447

1. PROJECT TITLE	2. PROJECT NUMBER	3. MISSION/AID/W OFFICE
GAMBIA MIXED FARMING AND RESOURCE MANAGEMENT PROJECT	635-0203	OAR/BANJUL

4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) 2

☒ REGULAR EVALUATION ☐ SPECIAL EVALUATION

5. KEY PROJECT IMPLEMENTATION DATES			6. ESTIMATED PROJECT FUNDING		7. PERIOD COVERED BY EVALUATION
A. First PRO-AG or Equivalent	B. Final Obligation Expected	C. Final Input Delivery	A. Total	$ 9M	From (month/yr.) FEB. 1981
FY 79	FY 86	FY 86	B. U.S.	$ 9M	To (month/yr.) MARCH 1986
					Date of Evaluation Review

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
Project has been completed. Major decisions include:		
1. Continued support for maize production and marketing.	GOTG	Not Applicab
2. Socio-economic data collection and analysis-computer installation.	GOTG	
3. Training of Agriculturalists within the Ministry of Agriculture.	GOTG	
4. Improve integrated maize-forage-livestock village trials.	GOTG/OAR/BANJUL	"
* The above goals to be continued by the AID successor project - Gambia Agricultural Research and Diversification	GOTG/OAR/BANJUL	"

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS

- ☐ Project Paper
- ☐ Financial Plan
- ☐ Logical Framework
- ☐ Project Agreement
- ☐ Implementation Plan e.g., CPI Network
- ☐ PIO/T
- ☐ PIO/C
- ☐ PIO/P
- ☐ Other (Specify) NONE
- ☐ Other (Specify) _____

10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT

- A. ☐ Continue Project Without Change
- B. ☐ Change Project Design and/or ☐ Change Implementation Plan
- C. ☒ Discontinue Project

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)

1. RALPH CONLEY, ADO, OAR/BANJUL
2. AMADOU TAAL, PERM. SECT., MANR
2. GLEN FULCHER, CHIEF OF PARTY, MIXED FARMING PROJECT

12. Mission/AID/W Office Director Approval

Signature: Byron Bahl

Typed Name: BYRON H. BAHL, AID REP.

Date: 9/23/86

AID 1330-16 (3-78)

PROJECT EVALUATION SUMMARY (PES) - PART II

GAMBIA FIXED FARMING AND RESOURCE MANAGEMENT PROJECT - (635-0203)

13. SUMMARY

The Gambia Mixed Farming and Resource Management project was designed in 1977-78 to foster intensification and integration of crop and livestock enterprises within existing Gambian farming systems so as to contribute to increasing net rural family incomes on an ecologically sound and sustained yield basis. The project was authorized in 1979, and the technical assistance portion of project was contracted out to the CID/Colorado State University which started field work in The Gambia in 1981. This Evaluation is the final evaluation of the project as the Project Assistance Completion Date (PACD) is September 30, 1986. It was originally evaluated in 1983 and findings indicated that the authorized funds and time were not sufficient to meet project objectives. Thus PACD was extended and the project was amended providing a life of project funding of $9 million. This has assisted in enhancing technical assistance, training imputs, and in implementing overall project objectives. The major problem encountered by project was that it did not complete all that was intended due to original funding status and design schedule. For example, gathering and analysis of data for monitoring and evaluation of the project's activities was not performed with dispatch. Nevertheless, the project obtained good field results in maize production, forage production, rotational grazing in the dry season, and the like. (See later sections).

14. EVALUATION METHODOLOGY

The purpose of this evaluation which is the final evaluation for this project, is to review and record the contributions the project has made to improve the well-being of the Rural Gambian Population through agricultural development. This evaluation addresses questions of agronomic, agricultural economics, sociological, and range management developments induced over five years. It is not an audit nor a diagnostic exercise aimed to improve methods or objectives in an ongoing activity.

The evaluation team comprised 1 Agricultural economist, 1 Anthropologist/Sociologist, 1 Agronomist and 1 Range Management expert. The team used a series of references (books, journals, project papers, reports) and consulted with mission staff, Mixed Farming technical assistance team, Gambia Government officials within the various ministries and departments who are responsible for agricultural matters, and also with selected farmers, and Peace Corps Volunteers in the regions where project was implemented. The draft report was critiqued and edited by the Assistant Director of REDSO/WCA.

15. EXTERNAL FACTORS

The project was designed during a period when the effects of the first Sahelian droughts were being contemplated by The Gambia Government (GOTG). Efforts were being made to improve food production and to give serious attention to the environmental degradation. The major national goal for GOTG was to increase diversification and production of crops and livestock. The Ministry of Agriculture was also involved initially to pursue adaptive research on crops and cultivation practices and to extend the findings. It also aimed at supporting farmers through management of cooperatives and provision of inputs.

The Gambia was incapable to carry out these services due to lack of adequate facilities and trained personnel within the various agricultural institutions. The Mixed Farming project, therefore, was timely implemented and it provided for these services by instituting technical assistance through experts resident in The Gambia, long-term training of Gambian professionals, and financing of basic facilities such as data collection, laboratories and transportation. The activities will be continued and more thoroughly institutionalized through the successor project, i.e., The Gambia Agricultural Research and Diversification project.

16. INPUTS

Projected Life of Project funding of $9m was not authorized at the design stage. Only $6m was authorized. Five years instead of four was required to carry out project objectives. The project had six components namely:

A. Land resource and use evaluation, classification and cartography;

B. Short and long-term training of Gambian professionals in the U.S. and on-job training done by technical experts;

C. Basic data collection and analysis;

D. Grazing areas development and management;

E. Improved crop and forage production and management;

F. Rural technology improvement effort.

The following is a list of project inputs to implement the above components:

INPUTS	IMPLEMENTATION ON TARGET		(ORIGINAL AID BUDGET)
			($000)
5 years each long-term field TA of:	Project Budget to 3/31/86		
	Host Country Contribution*		
2 Ag. Economists	salaries etc.:		
1 maize agronomist	$968,000 equivalent;		
1 forage agronomist	sites and services:		
1 range ecologist	$128,000 equalivant.		
2 years long-term TA of Ag. marketing expert. Short-term TA 26 mos:	AID Contribution ($000)		
	Technical Assistance		
	Photo/Cartography	720	849
	CID/CSU Contract	5125	2651
10 animal nutrition	Training	725	335
6 Ag. Engineering	Construction	450	417
6 socio-econ. analst.	Equip. and Supplies	1200	908
3 human nutrition	Operating costs	780	551
1 computer analyst.	Revolving fund	--	289
Equipment and Supplies (incl. ag. implements)			
Traineeships: 10 long-term, 8 short-term.	TOTAL	9000	6000
Field training by project staff. Aerial photography and cartography. Operations support (incl. data processing and extension support).			

17. Outputs became the following:

1. At least 7 village trials over 3 season.

2. 3 technological and managerial packages, including farm implements, animal and human nutrition.

3. At least 7000 maize farmers have techniques improved; results studied.

4. 3 large sample surveys, and data processed and analyzed; at least 3 special studies on farmers' behavior relevant to packages.

5. Comprehensive market studies on maize, livestock, groundnut processing.

6. 1:50,000 and 1:125,000 scale landuse maps produced and used in range management assistance to LOA).

7. 10 trainees complete long-term participant training. All necessary counterparts and extension and enumerator personnel trained in field. 8 participants given short-term training in USA or Nigeria.

The End of Project Status (EOPS) statement consolidates those of six origin logframes into one none-quantified one, as follows:

> Maize, forage and range management packages have been developed and tried in integrated village settings, Medium-scale maize commercialization programs have demonstrated (or not) the economical potential of this crop. Basic data developed by the project have contributed to refining packages and informing GOTG agricultural diversification and range resources management policies.

19. GOAL/SUBGOAL

The project was initially evaluated in 1983 and the goal was revised to conform with and support the major objectives of AID in The Gambia as follows:

A. Increased production of and farm income from a more diversified agriculture;

B. Improved information for and management of strategic agricultural development policy:

C. Improved management of natural resources necessary or complementary to agriculture; and

D. Balance of payments support which bridges what are hoped to be only temporary gaps in food availability and those recurrent budget resources devoted to essential agricultural services.

20. BENEFICIARIES

The project was instrumental in:

A. Raising the production/productivity and preparation of maize in The Gambia thereby increasing and diversifying food crop production;

B. It developed and refined techniques of experimentation with and extension to farmers and producer organizations, and it established innovative production techniques in mixed farming and range management.

21. UNPLANNED EFFECTS

The project introduced maize production and marketing. In some areas maize was substituting for groundnuts which is the main cash crop for the Gambian government and other food crops such as millet and sorghum. This resulted in a substantial increase in food supplies for human consumption, some for cash sale and additional crop residues for animal feed. This advantageous effect resulted in the design of a new project, The Gambia Agricultural, Research and Diversification project to succeed the Mixed Farming project and to continue some of its activities.

22. LESSONS LEARNED

A. New technology should be explored in a small-scale first and if successful to be expanded to a large area. This applies to:

(1) River access efforts of the range management plan;

(2) The development of the herbarium whose use in training was demonstrated;

(3) The market news operation.

These presented problems for the project as enough data was not collected prior to the project start date.

B. The maize production technology also presented problems as labor-saving devices were not introduced to ensure the smooth operation of the program.

C. It is necessary for project officers, the mission and project technical experts in the field to adjust to certain conditions that may be more feasible in implementing project. These may be contrary to project objectives at the design stage.

D. Data collection and analysis requirements should be limited to the country and projects capabilities which at times may be very expensive, time-consuming, and irrelevant.

23. SPECIAL COMMENTS OR REMARKS

The project has been very successful in introducing a diversified crop production in The Gambia. The Gambian Ministry of Agriculture has gained a considerable amount of experience from the CID/Colorado State University officials in the effective management of agricultural projects and agricultural institutions.

ATTACHMENTS:

Annex A Grazing Areas Development and Management-Component 1 - Pages A1-A29

Annex B Improved Crop and Forage production and Management Program - Component 2 - Pages B1-B26

Annex C Strengthening Ministry Planning and Evaluation Capacity - Component 3 - Pages C1-C18

Annex D Agricultural Skills training and Communications - Component 6 - Pages D1-D18

Annex E Economic and Technical notes and references. - pages E1-E20

MIXFAPES/BJS/jsb

FINAL EVALUATION

GAMBIA MIXED FARMING AND RESOURCE MANAGEMENT PROJECT (635-0203)

By: Dr. Floyd L. Corty
Agricultural Economist

Dr. Willian Derman
Anthropologist/Sociologist

Dr. Udai R. Bishnoi
Agronomist

Dr. James T. O'Rourke
Range Management Expert

Edited and AID-Specific Sections by:

Dr. James Osborn
Assistant Director, REDSO/WCA

(March, 1986)

CONTENTS

ANNEXES:

A. Component 2. Grazing Areas Development and Management.

B. Component 3. Improved Crop and Forage Production and Management.

C. Component 5. Strengthening Ministry Planning and Evaluation Capacity.

D. Component 6. Agricultural Skills Training and Communications.

E. Economic and Technical Notes and References.

ACKNOWLEDGEMENTS:

The team members wish to thank the staff of the Mixed Farming Project and their counterparts for their cooperative support, their tolerance and their hospitality. Appreciation and thanks are also extended to AID personnel for their administrative support and guidance throughout this evaluation.

In addition to the persons mentioned collectively above, the following deserve special mention for their gracious allocation of time and their willingness to share information:

Contacts and Interviews:

Sankung Janneh	Director, Department of Agriculture
Sompo Ceesay	Assistant Director, Department of Agriculture
Sambou Kinteh	Director, Program Planning and Management Unit
Abdoulie Sey	Principal Planner, Program Planning and Management Unit
Sidney Quartey	Director, Department of Animal Health and Production
John Fye	Acting Head, Soil and Water Management Unit
H.H. Schoof	Manager, FAO Fertilizer Program
Satt: B.A. Suware	Village Extension Worker, YBK
Malang A.A. Sanneh	Pasture Assistant, Fulladu West District
Momodou Fofana	Pasture Assistant, Niani District
Omar Jammeh	Pasture Assistant, Giroba Kunda Seed Multiplication Unit
Momodou B.K. Jobe	Pasture Assistant, Wulli/Kantora District
Fasainy Dumbuya	Counterpart of Marketing Specialist, PPMU

Dick Schumann	PCV, Jorem Bunda
Paul Jackus	PCV, Computer Room
Ian McIntyre	Director of the International Trypano-tolerant Centre
Derek Clifford	Chief Animal Production Office for ITC
Bakary Touray	Deputy Director ITC
El Haji Babo Ceesay	Farmer and President of Maize Growers Association, Mamutfana
El Haji Modou Satu Jobe	Farmer, Njoben (user of cultivator)
Yero Bah	SEU, Supervisor and Enumerator, Piniai
Sait Touray	Agricultural Demonstrator, Boiram
El Hadj Ousman Boi	Farmer, Boiram
El Hadj Abdullai Boi	Farmer, Boiram
El Hadj Modou Jagne	Farmer Boiram
Omar Njie	Enumerator, Njoben
Duncan Boughton	Ag. Economist, DOA, GOTG
Hamadi Bah	Farmer, Choya
Samba Sira Bah	Farmer, Choya

EXECUTIVE SUMMARY

The Gambia Mixed Farming and Resource Management Project was designed in 1977-78, authorized in 1979, and begun in the field in 1981 with a Master Title XII technical assistance contract let to CID/Colorado State University. It was evaluated in 1983, for the pressing reason that authorized funds and time were insufficient to cover the contract and inadequate to achievement of the project's objectives. The amended project provided $9 million and an extended Project Assistance Completion Date (March 31, 1986). It focused project efforts, eliminating one and significantly reducing another of the project's six original components. It enhanced, especially, technical assistance and training inputs, and sharpened the project's purpose, viz: "to foster intensification and integration of maize, forage and range management (livestock) enterprises to demonstrate feasibility of increasing farm incomes through this sort of agricultural diversification." This evaluation records and assesses the project's progress and accomplishments and notes functions which it would be worthwhile to continue in the successor AID project or through other efforts in The Gambia.

The Evaluation concludes that in difficult and pioneering circumstances the project achieved more of its basic objectives than not and has made a significant contribution to Gambian agricultural development to this point. Its major achievements include preparation and delivery of a tested maize production technology package that has impressively raised production and productivity in that important food crop. It provided the major advanced training for Gambian agricultural scientists and expert managers, with these fourteen individuals now prepared to take their part in Gambia's development. It produced a range resource inventory, important socio-economic studies, useful photomaps for resources management, an agricultural data system and an herbarium with 362 specimens of forage plants. It developed and refined techniques of experimentation with and extension to farmers and producer organizations of innovative production techniques in mixed farming and range management.

The project, however, did not complete all that was intended in its refocused and narrow version. What could profitably be continued by others are work on a package of forage production technology and integrated maize-forage-livestock village trials, *inter alia*. Generally, continued work on maize, its marketing and facilitated processing, and socio-economic data collection and analysis would be valuable. The AID successor project, Gambian Agricultural Research and Diversification, was designed to be able to absorb and continue those elements of Mixed Farming that appear on close examination to be targets of opportunity. But fully to assess the impact of the project evaluated here would require a retrospective examination in three to five years' time.

I. INTRODUCTION

The Gambia Mixed Farming and Resource Management Project was designed in 1977-78, authorized in 1979 and began in 1981. As authorized, the project would have had a duration of 51 months and a budget of $6 million. The primary vehicle for its implementation has been competed Title XII technical assistance contract, won by the Consortium for International Development (CID), with Colorado State University as the lead entity. A contract for five years of effort was signed in February 1981 whose cost and duration created a shortfall in authorized funds and duration of about $2 million and more than three years. Accordingly, the project was evaluated in April 1983 and amended the following summer, raising the total project cost to $9 million and creating a new Project Assistance Completion Date of March 31, 1986.

The purpose of the present, final, evaluation is to review and record the contributions this project has made to "improving the well-being of the Gambian Rural Population through agricultural development." (revised Goal, see Early-Term Evaluation). This evaluation is largely technical, addressing questions of agronomic, agricultural economic, sociological and range management developments induced over five years. That is, it is not an audit nor a diagnostic exercise aimed to improve methods or objectives in an on-going activity; as a successor project is already underway. Nor can this be an 'impact evaluation' or cost/benefit exercise, strictly speaking, because it is too early to assess lasting contributions of this complex and pioneering activity. Nevertheless, attempts have been made to discern lessons for The Gambia and AID and to recommend follow-on efforts of value.

II. OBJECTIVES AND METHODS OF THE PROJECT

The project was designed during a period when the effects of the first Sahelian droughts were seen not to have been ephemeral and donors and Sahelian countries were seriously concerting their efforts to improve food production and mitigate environmental degradation in the region. This small country of (then) 550,000 population depended then, as now, on groundnut export to earn foreign exchange; but even in periods of favorable terms of trade, increasing population and declining food grain output in the mid-1970s meant increasing food imports (rice, primarily) that boded ill. Increasing domestic food production and diversifying of crops with more beneficial crop and livestock raising associations lending to improved productivity became major national goals.

At the same time, an articulated agricultural and natural resources services system in the Government of the Gambia (GOTG) was attempting to pursue adaptive research on crops and cultivation practices and extend the findings, also supporting farmers through management of cooperatives and provision of inputs. However, The Gambia then and to this day is too impoverished and ill-placed to maintain such services above a threshold where they become truly effective and self-sufficient. Hence donor assistance AID in the period, for one, designed and instituted several major projects in agriculture and resources management. They were planned on the basis of highly imperfect information and heroic assumptions about implementation feasibility, efficasy of GOTG institutions, the weather and domestic political stability.

They, and the Mixed Farming Project (MFP) in particular, recognized at least that to make rapid advances intensive involvement over a considerable period by expatriate resident experts would be necessary, accompanied by long-term technical training of Gambian professionals dedicated to this work and finance of basic facilities such as data collection, laboratories and mobility (vehicles). This is a high risk and, in terms of discernable rate of return, expensive business. It takes the long view. It was undertaken after exploring alternative approaches and investments which were found wanting, and bet on the eventual pay-off of investment in applied agricultural research by university scientists and extension of innovations on the historical American model.

The MFP's purpose initially was simply "to foster intensification and integration of crop and livestock enterprises within existing Gambian farming systems so as to contribute to increasing net rural family incomes on an ecologically sound and sustained yield basis". This was to be achieved by support through two contracts of six components which the designers expected to be "not discrete packages unto themselves but highly interrelated and mutually supportive actions upon whose joint success depend the benefits of the project". One, Land Resource and Use Evaluation, Classification and Cartography, was to consist of aerial photography and landuse mapping based upon it with associated training in interpretation; it involved separate procurement contracts. The remaining five components, largely financed through the master Title XII

university contract, were to support training, basic data collection and analysis, three production/integration thrusts (maize, forage, and grazing area development), and a rural technology improvement effort.

The initial design foresaw the need for at least five years of field activities and around $9 million for achievement of the project's purposes. For reasons of their own, the AID project approval authorities saw fit to retain the full design but permit only four years of project life (the clock running before the contracting process had even begun) and $6 million. Thus it was known from the beginning, and especially after the master Technical Assistance (TA) contract was negotiated (costing twice as much and taking half again as long as the Authorization implied) that the project would have to be adjusted soon into its actual implementation.

This was fortuitious. Unlike some contemporary AID projects elsewhere in the Sahel, MFF had to be examined early in its career for financial and contractual reasons. But the Early Mid-Term Evaluation (April, 1983, two years after field commencement) provided the equally important opportunity to reexamine assumptions and components' content officially in the light of some experience and a better view of the practical. In this way, the project, the contractor's work and the GOTG's evolving perception of needs and opportunities could be treated with a flexibility and opportunism that is rare in highly structured technical enterprises of this type.

What emerged was vindication and added support for certain project thrusts and the reduction or abandonment of others. A realignment of technical assistance resources and specialities was made possible by the dedicated and forthcoming nature of the contractor's field team and home office. And this was supported fully by the responsible officers in the GOTG's Department of Agriculture (DOA), who already percieved success in field trials and work with farmers and producer associations by the TA team and its Gambian Counterparts. Section III and Annexes A-D of this report outlines progress across the six components. Their evolution is schematized in the Annual Calendar of MFP Activities on the next page.

ANNUAL CALENDAR OF MFP ACTIVITIES

The amended MFP thus recued and clarified the intent and mechanisms of the whole effort. And it is the project in this form which is being evaluated here. The revised Purpose, in logical framework terms, is "to foster intensification and integration of maize, forage and range management (livestock) enterprises to demonstrate feasibility of increasing farm incomes through this sort of agricultural diversification." Its End of Project Status (EOPS) statement consolidates those of six origin logframes into one none-quantified one, as follows:

> Maize, forage and range management packages have been developed and tried in integrated village settings. Medium-scale maize commercialization programs have demonstrated (or not) the economical potential of this crop. Basic data developed by the project have contributed to refining packages and informing GOTG agricultural diversification and range resources management policies.

Outputs and Inputs, of course, were quantified in the revised logframe and ensuing Project Authorization Amendment. The expected magnitude of Outputs became the following:

1. At least 7 village trials over 3 season.

2. 3 technological and managerial packages, including farm implements, animal and human nutrition.

3. At least 7000 maize farmers have techniques improved; results studies.

4. 3 large sample surveys, and data processed and analyzed; at least 3 special studies on farmers' behavior relevant to packages.

5. Comprehensive market studies on maize, livestock, groundnut processing.

6. 1:50,000 and 1:125,000 scale landuse maps produced and used in range management assistance to LGAs.

7. 10 trainees complete long-term participant training. All necessary counterparts and extension and enumerator personnel trained in field. 8 participants given short-term training in USA or Nigeria.

The presentation of Inputs follows below. Against the revised AID contribution to the project budget are compared the original allocations.

INPUTS	IMPLEMENTATION ON TARGET	(ORIGINAL AID BUDGET) ($000)	
5 years each long-term field TA of:	Project Budget to 3/31.85		
2 Ag. Economists	Host Country Contribution: salaries etc.:		
1 maize agronomist	$958.000 equivalent;		
1 forage agronomist	sites and services:		
1 range ecologist	$128.000 equalivart.		
2 years long-term TA of Ag. marketing expert. Short-term TA 26 mos:	AID Contribution ($000)		
	Technical Assistance		
	Photo/Cartography	720	849
	CID/CSU Contract	5125	2651
10 animal nutrition	Training	725	335
6 Ag. Engineering	Construction	450	417
6 socio-econ. analst.	Equip. and Supplies	1200	908
3 human nutrition	Operating costs	780	551
1 computer analyst.	Revolving fund	--	299
Equipment and Supplies (incl. ag. implements)			
Traineeships: 10 long-term, 8 short-term.	TOTAL	9000	6000
Field trainin by project staff. Aerial photography and cartography. Operations support (incl. data processing and extension support).			

*N.B.: no host country contribution required in Sahel (Sec 121) Program.

The major changes in the project following the Early Mid-Term Evaluation followed a detailed analysis of feasibility and priority among the numerous elements of the original project design. They were of two types: increases where resources were inefficient or new opportunities arose (TA, training, equipment and supplies and operating costs); and elimination of impractical elements. These, largely, were: (a) involvement with politically sensitive issues of water and trail access in national policy; (b) technical photo interpretation and national resource planning, which was deemed to be beyond the competence and essential mission of the project; and (c) provision of 1000 two-wheeled carts to farmers on credit through the Gambian Credit Union, which was concluded to be non-innovative and impractical due to the cooperatives' financial organizational difficulties.

The revised project was seen in 1983, then, to conform with and support the major objectives of AID in The Gambia. These were expressed in The Gambia FY 1985 Country Development Strategy Statement (CDSS) and reaffirmed in the FY 1986 CDSS Update (May, 1984). As expressed in the Early Mid-Term Evaluation, projects focus on agriculture and natural resources management. They should support: (a) increased production of and farm income from a more diversified agriculture; (b) improved information for and management of strategic agricultural development policy; (c) improved management of natural resources necessary or complementary to agriculture; and (d) balance of payments support which bridges what are hoped to be only temporary gaps in food availability and those recurrent budget resources devoted to essential agricultural services.

The expectation has been that the MFP's maize thrust, by way of diversification, will have explored thoroughly the feasibility of significant increases in production, sale and consumption of this important grain. And the project will have set the stage for further explorations with livestock as well. From its integrated trials and demonstrations of maize-forage-range production and management at the village level, combined with marketing analysis and adaptive research on nutrition, agricultural implements and small ruminants, feasible new interventions concerning these and other crops and products should present themselves. Likewise, the data base and analytical talent and systems generated should be materially useful beyond the project. At the policy level, key socio-economic, including marketing, information hitherto unavailable should inform decisions on future crop promotion, pricing and delivery of inputs and services.

Those have been the expectations of the MFP, reinforced by evaluation in 1983. Concurrent with the completion of the project's final three years, and especially in 1985, the lessons and achievements of the MFP were further critically examined in the course of design of its successor, The Gambia Agricultural Research and Diversification (GARD) project. That project will take a more evolutionary and systematized approach to the planning, financing and implementation of applied agricultural research and extension across a broader range of crops, products and input/output systems. In the establishment and operation of its Agricultural Research Management System (ARMS) the germaine scientific advances, village-level techniques, data, trained experts, and management lessons of the MFP will be absorbed. And it is hoped that this evaluation will be useful to that and other continuing efforts in The Gambia.

III. PROGRESS OF COMPONENTS

A. COMPONENT 1

LAND RESOURCES AND USE EVALUATION, CLASSIFICATION, AND CARTOGRAPHY

The objective here was to provide The Gambian Government with land use maps showing current land use patterns as a basis for developing national land use and resource allocation policies. This component of the project, was intended to assist the Government of The Gambia to obtain and utilize detailed large-scale aerial photographs with which to develop land classification maps for each of the five administrative divisions of the country. Land use mapping would be done by contract with an American Photo Interpretation cartography firm. Photographic missions were flown in December 1979 - January 1980 using high resolution photography at a contact print scale of 1:25,000. Resulting land use maps were to identify the three precipitation zones that influence vegetation types, soil formations and, to some extent, existing cultivation patterns. The mapping would also include delineation of existing land uses, villages, trial and road systems, and other standard features and political boundaries normally provided on base maps as specified by the GOTG.

A cadre of Gambian resource planning technicians capable of using and interpreting aerial photos were to be trained over the course of the project. The initial training and development of training materials similar to those found in the USDA Soil Conservation Service Training Manual and directly relevant to The Gambia would be done by outside consultants. This training would include aerial photo interpretation, simple mapping procedures, and care, storage and development of overlay maps. Once the initial training materials were developed, all subsequent training was to be done from within the Ministry of Agriculture and Natural Resources by trained local personnel. The Ministry of Agriculture and Natural Resources was subsequently reorganized to retain the Ministry of Agriculture as a separate unit and create a Department of Water and Natural Resource Management.

Implementation of this component would require U.S. contractual assistance for both the aerial photography and the photo interpretation, also assistance in mapping and training of local technicians. It was expected that all contractual activities under this component would be completed within two years from the signing of the necessary contracts.

The Contract for aerial photos, between GOTG and Teledyne Geotronics was signed Aug. 11, 1980. Aerial photo flights were completed Nov. 1980. Black and white prints were delivered Dec. 1980; and inframed photos in April 1981. However, quality of the photographs was too poor for them to be useful. Services of Precision Laboratories were contracted and new photos were developed from infra-red pictures. Land Use mapping was delayed because of the above difficulties. And training of photo interpreters was cancelled after the mid-term evaluation for reasons explained in Section II, above. A photo interpreter is currently engaged to complete the photo-mapping.

Nevertheless, the Range Management Advisor of the project has used the photos to identify communities and sites for demonstration plots, livestock watering points, deferred grazing areas and river access routes. The Department of Surveys used the photos in the conduct of the 1983 population census. The Soil and Water Management Unit found the photos helpful in their vegetative survey and classification. The Department of Forestry and the German sponsored Inventory and Mapping Project used the photos for forest inventory, fire control and mangrove surveys. And the Ministry of Agriculture finds the photos useful in irrigation mapping and development.

At least two other sets of aerial photos have been developed for The Gambia: one in 1972 by the Land Resource Division of the United Kingdom's Ministry of Overseas Development and the other in 1982 for the OMVG Project. Obviously there has been a duplication of effort in developing aerial photos. However, the designated purpose in MFP was to develop land use maps to show current land use patterns and serve as a basis for developing national land use policies and better resource allocation. This is difficult to accomplish. Existing national philosophies and political and social sensitivity to any change which infringes upon deep-seated, traditional land tenure systems will be strongly resisted. The Forestry Department, the Water and Soil Management Unit and the Department of Aninmal Health and Production should find these photo maps very useful if they are ordered and preserved properly.

Apparently the design of this portion of the project as far as allocation of land resource use and planning was concerned was not properly researched. Land use planning is at best a highly technical and controversial activity. It entails a knowledge and understanding of a country's land tenure arrangements, some specified in legal terms, others rigidly observed because of traditional or religious beliefs. And it was not within the competence of this project, nor centred to its or the GOTG's purposes to pursue this in this period

B. COMPONENT 2

GRAZING AREAS DEVELOPMENT AND MANAGEMENT

This component emphasized on-farm demonstration extension programs centered around deferred rangeland/crop residue feeding programs. It was successfully initiated in four village areas and shows possibilities of being highly successful if support is provided to expand the program to other areas. Unlike past efforts throughout Africa in the livestock sector, this program appears promising due to its total farm focus, integrating major disciplines.

The deferred rangeland/crop residue feeding program has been one of providing a higher level of nutrition to livestock in the last four months of the dry season. To this end a combination of deferred rangeland, with interseedings of introduced native and exotic grass and legume species, maize, millet or sorghum stover, rice straw, or groundnut hay are preserved for use during this critical period. Farmers have experienced less livestock mortality when involved in the program. Experience has been gained on the level of organization within the community that is necessary. A drawback to the program is the cost of fencing necessary in the initial stages. Fencing is an input the villagers find essential. It is hoped that this requirements will diminish with expansion of the program. Labor needs, the order of use of various feeds, appropriate and inexpensive building materials, the place of burning in the range program and small ruminant grazing are some practical refinements needed.

All other efforts within the component have been supportive of this major drive: the extension program of deferred rangeland/crop residue feeding.

Training has been appropriate both in depth and in numbers trained. The key element in training has been the time spent in the field by the Range Management Specialist helping Pasture Assistants and Range Officers apply the knowledge gained in formal degree training and workshops. Continued upgrading of both in-service and degree training will be essential to continued success.

Water development has been a very calculated and limited aspect of the work, utilized very selectively as an incentive for farmers to try the innovations, but successful at certain river points. Considerable attention in the future needs to be placed on monitoring livestock numbers, as better water access and improved forage supplies become available. Intensive herd management programs will be necessary, aimed at culling of old and unproductive animals.

A limited number of perennial forage species (seed of which is being produced by the project, of known quality and adaptability have been seeded into the deferred range areas. Much more research is needed in this area. Also needed is research on animal preference and performance when utilizing the various combinations of native and introduced forages, native range forage and crop residue. The use of woody species as browse and fuel has yet to be studied.

Range resource inventories and vegetation mapping have been, or are being, accomplished. Much of the mapping work has resulted in a dilution of other efforts with questionable benefit in itself. Vegetation analysis has been valuable both to provide baseline information from which to judge changes due to innovations and as a training exercize for field level personnel. An excellent herbarium has been established to support future field work.

Of utmost urgency is the need to establish a Rangeland Unit within the Department of Animal Health and Production (DAPH). It must have Gambian Government support but cannot survive on that support alone at the moment. Outside donor assistance is needed to prevent the disappearance of personnel and programs.

See Annex A.

C. COMPONENT 3

IMPROVED CROP AND FORAGE PRODUCTION AND MANAGEMENT

There are two aspects of this activity; improved forage production and management and maize improvement for increased food and feed production.

1. Improved Forage Production and Management Program:

Designed to determine the potential of introduced grains and legumes to increase total vegetation available for grazing, the specific objectives here were to:

a. survey information and materials about improved forage species in The Gambia;

b. introduce and evaluate cultivars of exotic tropical grass and legume species;

c. demonstrate potential for extending dry season grazing by introducting a forage legume into fallow lands and better utilization of groundnut hay;

d. conduct grazing trials;

e. develop a seed production program to increase supply of suitable and adaptable grass and legume species; and

f. train Gambian animal husbandry specialists in forage improvement.

Several legumes were introduced from Australia, CIAT and other sources. Trials on locally available promising grasses and adaptable legumes were initiated. The MFP forage agronomist in cooperation with the range specialist, promoted better use of crop residues through improved harvesting, storage, and feeding of maize and sorghum stovers, and groundnut hay. Livestock feeding trials and chemical analysis of crop residues were conducted. Better utilization of groundnut hay was achieved by mixing with maize stover for feeding to prevent weight loss in ruminants. Enough seed was multiplied (at Sapu) and harvested from promising adapted legume accessions, to plant forage nursery plots during the 1984 season.

However, some of the proposed studies listed in the original project and follow-up of Early Mid-Term Evaluation recommendations were not carried out; or attempts were made but were not successful in meeting the specific objectives of improved forage production. Instead of intensive seed multiplication of adapted legumes/grasses to plant large plots to observe yields and conduct grazing and feeding trials, efforts were directed to work on commonly cultivated legume crops similar to ones conducted by the maize agronomist for intercropping. Also, most of these activities and extension plans

were turned over to inexperienced counterparts. The animal nutritionist, who returned in October 1984, was burdened with forage analysis, rather than proceeding with work on nutritional trials. Most of it was to be done in an ill-equipped soil testing laboratory or in a new forage analysis laboratory which is being established. Thus, as expressed by most DOA and DAHF administrators and MFP counterparts, the project was unable to deliver a tested package on forage production technology for farmers.

3. Maize Improvement for Increased Food and Feed Production:

In order to increase the production of maize for both human and animal production, this activity proposed to:

a. develop technological packages to improve maize production and consumption as food and feed;

b. expand maize cultivar testing at research stations;

c. conduct trials on fertilizer response and plant densities;

d. plan and develop a maize seed improvement program;

e. train extension assistants and demonstrators in delivery of technological packages developed through mixed farming centers;

f. introduce maize sheller and train in its use; and

g. determine availability of maize stover and its value as livestock feed.

The technological package containing date of planting for selected cultivar (NCB) with recommended plant density and rates of fertilizer application has been made available by the MFP. Plans for seed multiplication of a recommended variety (NCB) were developed. Maize shellers and mills were procured and distributed for demonstration. improved harvesting, storage and feeding trials on maize stover an animal feed have been achieved. And a sufficient number of Agricultural Assistants (AAs) and Agricultural Demonstrators (ADs) have been trained to conduct and demonstrate the production package to farmers.

MFP also trained one senior officer, one maize agronomist and two Gambians at B.S. level majoring in Agronomy. These personnel were able to carry out the original package and proceed with most of the recommendations made by Early Mid-term Evaluation to make improvements in maize production technology. This major success can be attributed to their concentrated effort and skill in gathering available information from the DOA, making use of the Maize Growers Association, getting a fair price approval for maize from the government, organizing 'Kafo's' and their representation in the farmer's cooperatives and last, but most important, teaching and convincing farmers that maize is an important food and cash crop.

MFF was very successful in preparing and delivering a tested maize production package technology for The Gambian farmers. Most DOA and DAHP administrators and MFF counterparts have commended this success. Further, its success is also demonstrated by the increase in maize area from about 2,600 hectares at the beginning of the project to 18,000 hectares by end of 1985 .' The average national yield has increased from 1.6 t/ha to 2.5 t/ha and there is a significant increase in number of maize growing farmers. (Tech. Rpt. No. 3 by Kidman and Owens). The production and food preparation training to several women's societies (40-70) was fairly successful and had an impact on adaptation and increased production of maize. Women have learned to produce maize as a field crop, consume maize flour in a number of recipes, improve their family diets, and to sell surplus maize when the price is high (Tech. Rpt. No. 4 by Marlett and Sambu).

(See Annex B.).

D. PROJECT COMPONENT NO.4

IMPROVED RURAL TECHNOLOGY

Anything that eases drudgery, saves time and increases productivity is an improvement in rural technology. In this instance the emphasis was directed towards the following objectives:

1. Introduce and demonstrate the use of farm carts in a mixed farming system.

2. Establish a revolving farm credit fund to facilitate purchase o farm carts.

3. Establish compound storage facilities for farm produce, particularly maize and crop residues.

4. Work with the Department of Animal Health and Production to provide improved feeding and nutrition through the use of mixed farming products.

5. Work with Livestock Owners Associations through demonstrations aimed at improving management of crop residues and, forage preservation.

At the outset, there were numerous delays in getting the project started. The annual schedule of activities was frequently disrupted. Initially, the farm cart program was perceived as establishing a revolving credit fund. The project team took the position that the program could be made more effective by demonstrating utilization of carts in operations of the livestock sector. By the second and third year of the project, some 400 or more carts were expected to have been distributed.

In addition, it was expected that crop residues, normally wasted, would be salvaged to help feed animals during the dry season. Farmers would be taught the value of providing quality feed to livestock. Finally, there would be an economic assessment of achievements in:

(1) improved utilization of crop residues;
(2) marketing of higher quality products;
(3) increased productivity and reduced mortality of livestock.

By the time of the early Mid-Term Evaluation, April 1983, it was concluded that this activity was highly diversionary to the forage agronomy research effort, was not really innovative, and was impractical in view of the credit difficulties encountered by the Gambian Credit Union.

Thus the accomplishments of this component were quite limited. There is no record of economic achievements. Any benefits derived were absorbed in the conduct of further forage and livestock activities.

E. COMPONENT 5

STRENGTHENING MINISTRY PLANNING AND EVALUATION CAPACITY

The project paper called for the establishment of a Socio-Economic Unit (SEU) to be staffed by one agricultural economist, one rural sociologist and their counterparts. The SEU was to perform four functions: provide information of a quantitative and qualitative nature describing and analyzing the livestock and land use systems in The Gambia; test at the field level the particular technological packages developed by the project; monitor changes over time as a result of project interventions in order to ascertain if the packages and/or strategies proceeded as anticipated; and build up a core of Gambians with a micro socio-economic orientation in the Ministry of Agriculture.

Throughout the life of the project there has been a tension between the data gathering functions of SEU and project implementation. Key to this tension was SEU's reluctance or inability to alter its stringent data collection requirements. These included doing a baseline survey on two and one-half percent of Gambian compounds followed by farm management studies in nine villages using the FAO Farm Management Data Collection and Analysis System. This meant that while the technical components were in the field identifying constraints to production in agriculture and livestock, SEU was not involved. Instead, SEU's efforts went to data collection which involved recruiting, training and posting twenty-three enumerators, and one junior and one senior supervisor. To compound problems, there were unforeseen difficulties in data processing and analysis some of which were never resolved. This led to the SEU not being able to perform the functions which were envisioned: to bridge the gap between the components and disciplines represented in the project and to increase the efficiency of the developmental and implementation foci of the project. However, this was probably an overly idealistic goal under the best of circumstances and an impossible one under the conditions described in Annex C.

Following the Early Mid-Term Evaluation completed in April, 1983, several recommendations were made to shift some directions within SEU and to resolve some difficulties. It was decided to shift data processing operations from Colorado State University to micro computers in The Gambia. This was done successfully. A marketing specialist was added to the SEU staff to identify constraints and patterns in maize and livestock marketing. In addition he implemented a marketing survey to provide data for his studies as well as price information to producers and traders over Radio Gambia.

With the arrival of a replacement agricultural economist and a rural sociologist several changes took place. These included: the development of integrated village trials of the implementation thrusts of MFP; the development of a maize crib to reduce loss; the development of a survey instrument for The Gambia National Agricultural Survey; the development of a new farm management instrument to replace the unworkable FAO FMDCAS program; completion of the livestock owners association report; and farm management studies in the integrated villages, a series of short monitoring papers on issues arising from the Jahaly-Pacharr irrigated rice project were among some of the most important activities.

Much of the work by the marketing specialist, the agricultural economist and rural sociologist has been guided by the principle that SEU was to be folded into The Planning Programming and Monitoring Unit (PPMU) for the agricultural sector in the Ministry of Agriculture. The paramount purpose of PPMU is to institutionalize a planning system in the Ministry of Agriculture. It is clear that PPMU has to gain the greater respect and confidence of the relevant technical departments and statutory bodies to be more effective. However, since the directorship of PPMU changed in July of 1984 there has been a close and firm working relationship with SEU. As MFP ends it will have achieved the training of three senior staff at PPMU, a rural sociologist, an agricultural economist and a computer specialist (who already had achieved an Ms. on his own). In addition, eighteen of the twenty-five enumerators who worked for MFP have now been hired by PPMU.

The overall objective of Component No. 5 of achieving a socio-economic unit to plan and evaluate projects rests upon work still in process at PPMU. Its success will depend upon the overall future of PPMU and its ability to generate some outside assistance.

COMPONENT 5

AGRICULTURAL SKILLS TRAINING AND COMMUNICATIONS

Long-term degree training funded by MFP exceeded the numbers expected. That training provided these individuals with the technical skills to accomplish individual functions within their disciplines. Short-term training in-country was very effective and provided field level personnel their first exposure to many of the activities in which they have been involved. However more in-service experience and advanced degree training will be necessary for majority of these trainees to plan and execute national programs.

Peace Corps Volunteers assigned to the project were far fewer then planned but those who were assigned performed well in key roles.

Daily on-the-job training provided by contact between the U.S. and Gambian counterparts was excellent in some cases and acequate in others. This aspect of training was an essential ingredient and the good working relationships and mutual respect achieved between the CSU contract team and their Gambian counterparts and higher officials are commendable.

See Annex D.

IV. EFFECTS AND IMPACTS OF THE PROJECT

A. A View of Accomplishments

Considerably more detail than is provided in Section III, above, may be found in the annexes, concerning the MFP's individual components. The sequence of operations and accomplishments of this complex, technical project began in the fall of 1981, when project personnel were fairly well installed and organized to begin development activities. At that time, a baseline survey questionnaire was developed by the Socio-Economic Unit (SEU); a sample was selected and 25 enumerators were trained to collect data. In addition, five Peace Corps Volunteers (PCVs) joined the survey. Before the year was out, a maize production package was developed and a seed multiplication program planned. Efforts were also directed towards getting a range management program started and to this end seven pasture assistants were selected from the Department of Animal Health and Production (DAHP) to work with the range management advisor.

During the next two years, 1982 and 1983, project work concentrated on field surveys, demonstrations, training, introduction of the maize package and promotion of maize as an important food supplement to the traditional staple diet of millet and sorghum. Activities included the Socio-economic survey of 582 compound heads and first wives. Training of enumerators continued and 11 enumerators were posted in nine villages to do farm management studies. A cattle herd survey was planned and 18 demonstration plots were established to show the benefits to be derived from seeding, weeding, limited strategic fencing, and deferred grazing of pasture and range. The maize package was being promoted for feed, food, storage and commercialization; intercropping with legumes was tested; a maize/fertilizer credit program was tried and failed after one season. The women's food preparation demonstration, however, was judged to be only fairly successful in introducing maize into the rural Gambian diet.

The years 1984 and 1985 were the more productive years of the project, resulting from the planning, preparation and groundwork done the three preceeding years. Among the list of accomplishments, one should note the following:

- Range/forage plots set up at YBK.
- Livestock feeding trials conducted at Boiram, Yundum, and deferred range/crop residue feeding programs extended into four villages.
- Fencing demonstrations conducted for 28 forage storage areas.
- Eight phototype cultivators distributed for farm trials.

- Workshops conducted annually for Pasture Assistants, Livestock Assistants, Agriculture Demonstrators, and Agriculture Enumerators. Long-term degree training provided for 14 individuals. Numerous training sessions on technical topics, and special workshops provided on agricultural marketing, farming systems, research, and applied computer skills. Laborers trained in vocational skills.

- Completed range inventory on 465,345 hectares and expanded seed multiplication plots at YBK and Giroba Kunda.

- Completed multi-year year herd study.

- Built nine village grain storages.

- Established a forage analysis lab., and an Agricultural Market News Service for cereal crops, vegetables, livestock and fish.

- Developed a video tape to document project's activities.

- Data collected for program evaluation in four villages.

- Financed and supervised 85 maize cooking demonstrations.

- From 1700 measurements collected at an abbatoir, developed a scale which gives cattle weights corresponding to girth measurements.

- Collected and labeled 362 plants for the herberium.

- Completed 15 on farm maize/legume intercropping trials.

- Established gamba grass grazing capacity trials at Yundum.

- A major studies completed on food production/consumption linkages, and detailed farm management and marketing studies nearing completion.

- Integrated Socio-Economic Unit with Program Planning and Management Unit (PPMU).

A person glancing over the list of activities and accomplishments during the five year life of the project must certainly realize that the strengths and worthiness of the project rest as much or more with its wide ranging extension efforts rather than its adaptive research results. That is not to say that research wasn't accomplished. Research was initiated and pursued, as evidenced by numerous surveys and tests or trials that were conducted successfully and importantly on forage, the maize package and range management. Surveys include the baseline survey, cattle herd survey, marketing survey, and farm management survey. These surveys provided data for analysis, interpretation, and research findings just as controlled trials or tests provice data for analysis and reporting of the more typical laboratory research results.

But it is the extension of technique, through trained Gambian professionals, and the extended effort with specific rural populations that have paid off. What is of enduring value and intense is the experience of farmers, cattle raisers and the preparers of food for consumption -- across a broad enough number of them, over sufficient time - which has improved their condition and had a demonstration effect. In fact, it is inescapable that extension activities related to the maize production package, in particular should be continued. To improve the well being of the rural sector, efforts should be extended beyond the progressive farmers who participated in this project to reach, the majority in regions where maize can be cultivated, consumed and traded..

As to rural acceptance of specific measures to integrate crop and livestock production, the following are considered sustainable and worthy of continued efforts.

B. Impact On Food Production

To answer the question what impact did the maize program have upon food production?, it is interesting to compare data for maize with data for groundnuts for the five years before the MFP program became operational with the last five years of available data. Assuming that the 11 year estimates of crop production data, reported in the Ministry of Agriculture and PFMU Paper No. 10, are reasonably accurate, then Table 1 gives a fairly clear picture of the degree to which maize production is replacing groundnut production. It is generally assumed that the increase in maize planting and production largely replaces other food crops, especially millet and cash groundnuts. There has been a very perceptible decline in groundnut production in the past few years because of unfavorable market prices.

Making the comparison between the average annual production for the last five years with the first five years of the 11 year period, 1975 to 1985 removes variations due to climatic conditions. Accordingly, the area devoted to maize production shows an average increase of 3,400 hectares compared to a decrease of 6,200 hectares of groundnuts. Similarly, the volume of maize production increased an average of 4,100 tons while groundnuts decreased am average of 24,700 tons. In some instances farmers reported that maize

plantings replaced some of the millet plantings. In the aggregate, however, national figures show a substantial increase in area planted and in total production of millet in the last five years of the eleven year period.

Table 1: Comparision of Annual Average Planted Area and Production of Maize and Groundnuts, The Gambia, 1974/75 to 1984/85.

Annual Averages	Maize	Groundnuts
	Hectares Planted (000 Ha.)	
1974/75 to 1978/79	5.4	102.6
1980/81 to 1984/85	8.8	96.4
Area Difference	+3.4	-6.2
	Volume Produced (000 Tons)	
1974/75 to 1978/79	7.2	132.6
1980/81 to 1984/85	11.3	107.9
Product Difference	+4.1	-24.7

Source: Derived from Annex Tables and

If the data are reliable, then it would appear that the increase in food production, as contributed by the maize program, has not been sufficient to overcome the decline experienced in the production of groundnuts.

Preliminary data for production year 1985/86, however, indicate a gross total production of cereals at 127,590 tons, or a net total production of 99,840 tons, after allowing for losses from rodents insects and spoilage. This latest gross total production figure is greater than total production for any previously reported production season. The next highest production year occurred in 1982/83 with a total production of 101,380 tons.

Table:

Annual Estimates Of Planted Area, Yield And Production
Of Maize, The Gambia, 1974/75 to 1984/85

Year	Planted (000 Ha)	Harvest (000 Ha)	Yield (Kg/Ha)	Production (000 Tons)
1974/75	5.5		18.73	10.3
1975/76	4.4		11.04	4.8
1976/77	4.04		11.29	4.5
1977/78	6.21		11.31	7.0
1978/79	6.8		13.96	9.5
1979/80	8.5	5.4	12.28	6.6
1980/81	6.68	5.9	10.68	6.6
1981/82	8.74	7.6	16.45	12.25
1982/83	10.02	9.31	18.00	17.00
1983/84	8.44	6.88	12.41	8.53
1984/85	10.02	9.20	13.57	12.48

SOURCE:
Eleven years of Farm Production Data, 1974/75 - 1984/85, Ministry of Agriculture, PPMU Paper No. 10 Banjul, January 1985.

NOTES: FAO data for same years correspond to the above figures. Average yield of maize per hectare the last five years was 1,422 compared to 1,327 in the first five years, an increase of 95kg @ D.465 = 44 Dalasi gain per ha. assumed due to improved technology.

The annual average area devoted to maize production in the last five years of the 11 year period showed an increase of 3,400 hectares over the average for the first five years.

Similarly, annual average production of maize was 4,100 tons greater, the last five years of the 11 years period than for the first five years.

Table: 3:

Annual Estimates of Planted Area, Yield And Production
Of Groundnuts, In The Gambia, 1974/75 - 1984/85

Year	Planted (000 Ha)	Harvested (000 Ha)	Yield (Kg/Ha)	Production (000 Tons)
1974/75	104.8		13.85	145.2
1975/76	98.8		14.29	141.12
1976/77	107.6		13.29	143.0
1977/78	105.4		9.49	100.0
1978/79	106.2		12.56	133.4
1979/80	96.9	67.8	9.86	66.9
1980/81	82.54	68.9	8.74	60.2
1981/82	92.5	80.7	13.49	108.9
1982/83	98.5	95.0	15.93	151.35
1983/84	109.96	97.16	11.72	113.84
1984/85	98.49	91.36	11.50	105.06

SOURCE:
Ministry of Agriculture and PPMU, Paper No. 10

Table: 4

Annual Estimates of Planted Area, Yields and Production of E. Millet in The Gambia, 1974/75 - 1984/85

YEAR	PLANTED (000 ha.)	HARVESTED (000 ha.)	YIELD (kg/ha)	PRODUCTION (000 tons)
1974/75	5.5	-	1135	6.7
1975/76	6.5	-	561	3.6
1976/77	4.6	-	660	3.0
1977/78	6.36	-	688	4.4
1978/79	10.0	-	945	9.54
1979/80	2.3	1.7	941	1.67
1980/81	9.04	6.0	898	5.4
1981/82	12.5	11.4	1270	14.5
1982/83	19.4	13.6	1241	16.9
1983/84	19.5	14.1	1020	14.4
1984/85	21.3	19.2	1197	22.9

SOURCE: Ministry of Agriculture and PPMU Paper No. 10

NOTES: Average annual area planted to millet the last five years was 16,500 hectares compared to an annual average of 6,600 hectares the first five years of the eleven year period. Thus, it is reasonable to assume the increase in maize area did not occur at the expense of millet.

Likewise the average annual production of millet was 14,800 tons the last five years compared to an average of 5,400 tons the first five years.

C. Impact On Well-being of Farmers and Rural People

As indicated above, in 1983 there were 2,600 hectares of maize planted with the MFP technical package. Because of the severe drought that year, yields were quite low. Farmers still regarded maize as one of their best crops, so in 1984 some 12,000 to 15,000 hectares of maize were planted. Undoubtedly, this was not a net increase in crop area planted. Maize was substituting for groundnuts and possibly some millet and sorghum. Nevertheless, the increase in area devoted to maize production translates into a substantial increase in food supplies for human consumption, some for cash sale, and additional crop residues for animal feed.

Assuming that the reported estimates are reasonably reliable and that 17,000 to 18,000 hectares were put into maize production in 1985/86 production year, and assuming an average conservative yield of 1.5 tons per hectare, selling for D800 to D1000 per ton, then it can be said that the aggregate value of maize produced would amount to D23,625,000.

(17,500 ha X 1.5 tons X D900 = D23,625,000 or at D5 per $1 would be $4,725,000).
However, it should be noted that PPMU estimated maize area at only 10,020 hectares and yields at 1.4 tons for 1984/85 crop season.

The values estimated above are not cash income. In the strict sense cash income would be realized from marketing the maize.

In the absence of reliable data, it would be necessary to estimate what proportion of total maize production is marketed. The nearest response to this question, as reported in a Maize Marketing Survey, states that "only limited amounts of maize grown by respondents were sold for cash. 93% of growers surveyed sold none or very little of the maize produced, "(44,P.3). A rough estimate might be ten percent or less. If so, 10% of D23,625,000 would reflect cash incomes of D2,362,500. More reliable data will be published later from the farm management studies being carried out in the integrated villages. How far one will be able to generalize from this data is uncertain.

In addition to economic gains to farmers, they have realized social and technological benefits. On the social side, their well being was enhanced by the maize program. Expansion of maize production means that farmers now have a multi-purpose crop that matures in 90 to 100 days; it is easy to raise, provides relatively high returns, is easily stored, requires less labor to produce, is nutritious, provides more versatile diets; and the stovers provides animal feed. Currently maize has few pests and no diseases. It does require fertilization and improved seeds to maintain vigor. The credit program for farm purchases of fertilizer, seed, and implements was also a socializing activity. Unfortunately it was discontinued when many farmers failed to honor their credit obligations. This poor credit record is often blamed on the fact that, in the past, delinquent accounts were erased by the government.

Technological benefits to farmers have accrued from the training and skills imparted through workshops, and demonstrations for improving productivity, storage, and marketing of crops and livestock. Additional benefits of the project, include demonstrations in fencing, deferred grazing, use of forage residues, intercropping, reseeding of fallow lands, developing watering points, access routes, computer training courses, conduct of a two-week agricultural marketing course, completion of the first of series of monitoring studies on the Jahally/Pacharr Rice Project in cooperation with PPMU, conducted 15 on-farm maize/legume intercropping trials, expansion of forage seed multiplication plots, testing of herbicides in maize seed production, established Gamba grass plots and tested carrying capacities, and conduct of maize/cowpea intercropping trials for 26 women's societies.

MFP assistance to women's programs has expanded interest and participation in agricultural activities. Twenty women's societies participated in the maize/cowpea intercropping program and maize cooking demonstrations were conducted in 85 villages. In addition, five training sessions were conducted to train female agricultural demonstrators on how to present cooking demonstrations at the village level.

The 1982 baseline study, in which compound heads and first wives were interviewed, presented information on their aspirations if their incomes were to increase substantially. Items such as housing-repairs or building were mentioned most frequently, followed by farm equipment purchases, food and livestock. Acquiring clothing, education, or health services had lower priorities than buying draft animals. Unfortunately, there was no follow-up study to see whether any of these aspirations were realized subsequent to development activities introduced by the MFP. As for livestock, cattle made up about 40 percent of all livestock found in compounds. The median number of cattle owned by compound heads was five head. Herding by contract is the most frequent pattern of livestock husbandry in rural areas. Almost 40 percent of cattle owners had sold some cattle within a twelve month period. (25p. 24).

D. Impact on GOTG Policies

Since maize has become a highly valued crop in the Gambian farming system, it has influenced pricing policies of GPMB both directly and indirectly. Formerly, most harvested maize was used locally. What was sold in the market was often finding its way into neighboring Senegal where prices were as high as D900 per ton. This practice was of considerable concern to government officials who were much aware of the need to attain food self sufficiency in The Gambia.

In October 1985, the government raised the producer floor price of maize up to D600/ton which was formerly D390 per ton. In addition marketing arrangements were changed. Instead of the GPMB buying the crop, local cooperative societies were to buy all cereals and in turn sell to the Gambian Credit Union (GCU). This new pricing and marketing structure was a welcome relief for farmers. Moreover, the price set by the government is a floor price and many farmers are able to sell in the parallel market at higher prices then those offiged by the GCU's.

E. Institutionalization

MFP, like many other projects, would like to be evaluated in terms of their success in initiating, and developing answers to constraints in maize and livestock production. MFP explicitly tried to develop alternatives which could be self-sustaining by farmers and herd owners without outside assistance or at least with minimal assistance. How well did the project identify and address sociocultural constraints to increased production and local organizations as agents for technological change and agricultural development?

MFP did very well in identifying constraints which were less socio-cultural in nature, than they were of input shortages, capital shortages, and weakness of extension efforts. MFP was responsive to the complex timing patterns of Gambian farming systems and concentrated on maize which could be expanded without seriously jeopardizing other parts of farming systems. MFP succeeded in developing a technological package of which only part was adopted by any given farmer. The package for livestock was more experimental in nature although well thought out in terms of the real production constraints that herders understand. The use of maize stover for livestock feeding has expanded in the Upper River Division in areas with no direct MFP activity. This is a good indication of its usefulness and

The appropriate local organizations for these changes is more problemmatical. MFP in effect created kafos (which in the past were cooperative work groups but now has lost much of that meaning) of ten members each to receive the MFP package. A survey done in Boiram and Piniai showed an initial lack of money to pay for the fertilizer. Prior to 1984 the fertilizer was provided on a demonstration basis without cost. There was a shift in policy in 1984 to set up kafos to demonstrate how they could serve as a revolving credit organization. Each farmer was to plant one hectare of maize, to obtain the fertilizer the first year on credit, and to provide the seed themselves. Which farmers participated was a decision made by the maize agronomists not by the SEU.

While the revolving credit system was explained to the villagers, they still didn't fully understand the changes that had taken place, or chose not to repay their fertilizer debts fully, perhaps in the hope they would receive it anyway. (The actual rates of repayment will be included in the maize report.) Farmers who repaid their fertilizer loans received their next fertilizer bags at the previous year's price. This was certainly an important incentive to help repayment rates but it is unclear that it can be continued. The issue that emerges clearly has to do with what local groups, if any, will be able to handle a revolving fund for fertilizer credit and its repayment? MFP experimented with ten person kafos.

Clearly with the whole village growing maize this is not adequate. Or alternatively, should fertilizer purchase simply be on a pay as one can basis which will negatively impact upon smaller, less wealthy farmers? The issue is important although beyond the scope of both the MFP project and this evaluation but needs detailed attention in any future projects.

MFP identified some of the impacts upon women. However, there are several issues remaining that deserve consideration: 1. the degree to which the shift from early millet to maize has increased the work of women processing the maize; 2. the amount of maize being sold in comparison to that of early millet and the disposition of that income. Very different estimates were given to us by different members of MFP which indicates that there is great variability both within and between villages and districts; 3. the viability of women's societies actually growing maize given other work demands. While efforts were made to have them do so all too often the work could be done only on their rest day which reduced their needed rest as well as rendered less effective their work on maize fields.

The Maize Growers Association has been cited by many as critical for the success of maize cultivation in The Gambia. It remains unclear that maize will become that important in the farming system at the national level (it may well do so in certain districts) and that a national organization will survive. In any event this is an organization that should be left alone to see if there is both the need and political space for such a commodity focused organization.

The livestock part of the package appears less sustainable without continued outside assistance at least in the immediate future. The economic benefits appear to be less (this awaits a fuller economic analysis in the livestock report) while the social costs are higher in terms of labor use for harvesting stovers. In addition, livestock ownership is much more skewed with a relatively small number of owners have large numbers of livestock. This pattern obtains more for cattle than for small ruminants. Much has been achieved, more than might have been expected in terms of the use of crop residues and the maintenance of protected pastures. There is a clearly perceived village need to improve the condition of animals as well as to reduce conflict between agricultural activities and herding. MFP has identified some of those constraints and the work needs to be built upon. However, the viability of the LOA;s particularly at the District Level needs to be questioned. They appear to be dormant with the exception of those working with either ITC or MFP. The District level is too large for cooperative working relationships while the village is perhaps too small of a unit for range management.

The planting of grass for pasture has been of interest. While on the surface it appears to be an impractical activity there is the clearly perceived and understood deterioration of the natural environment, including range.

There will be difficulties in the social acceptance of planting grass for it then becomes a crop. If it is a crop, then the right of disposal belongs to whomever works the land. On the other hand, pasture or rangeland is not restricted for animal use although there are clearly arrangements made between herders and fieldowners as to who grazes crop residues. There are two difficulties then in moving toward planting grass: the labor requirements during the rainy season and the fact that grasses would take lower priority then crops, and secondly alterations in the use of range. Both of these would be longer term efforts and are unlikely under current circumstances to be sustained. But because of increased land pressure and conflicts between agriculture and livestock efforts in this direction will have greater support than one might have assumed prior to MFP.

Extension and upgrading of extension work was observed above, was one of the most important parts of MFP's success. The extent of institutionalization in the sense of sustaining the effort, enthusiasm and hard work remains to be seen. Many studies have been done of extension and its problems in The Gambia. Projecting the results from those studies on to the likelihood that the same spirit, cooperation and dedication will continue leads one to be sceptical about how effective extension will be without follow-up activities.

F. Final Note

It is very difficult to evaluate incompleted work. This project, at the time of writing, is not quite finished. Its major final substantive reports are not out and much data analysis will never be done that could have. Over-all, the major problem revolved around the three year separation of SCU from the technical thrusts of the project, a gap which was partially closed in the last two years.

The project kept a clear and restricted focus upon maize, range, forage and livestock and support to PPMU. It is evaluators' feeling, since much of the documentation could not be obtained through field investigation or was not available in monitoring and evaluation studies, that many of the gains registered by MFP will not be sustained without continued outside inputs. The major constraint to increased productivity with respect to maize is fertilizer. Since much work has already been done on the fertilizer issue in The Gambia one may simply signal that it is critical for continued success of the MFP program. Further work might be undertaken on a more effective utilization of manure anticipating problems in input supply or the continued selling of fertilizer in Senegal if the price remains higher.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Results

The results or achievements of the MFP as it works down to an end are quantifiable to a degree and qualitative as well. The project's original conception did not lend itself to a unified objective or procedure; so no unified, completely coherent set of results can be ascertained. Nor is that to be taken as a criticism of the way things have worked out, given Gambian conditions. On the whole, the project achieved more of its basic objectives than not and has made a significant contribution to Gambian agricultural development to this point. An ordered, brief list of results might be as follows:

1. MAIZE: Success in preparing and delivering a tested production technology package, and increase in maize area cultivated in the country from 3,500 ha. to 18,000 by the end of 1985. Average yield increased from 1.6 T/ha to 2.5. There was successful seed multiplication and introduction to women (85 demonstrations) of food preparation and nutritional techniques. More than 100 Agricultural Assistants and 300 Agricultural Demonstrators were trained and can now carry on some of the work.

2. TRAINING: Long-term training was provided for fourteen Gambian professional counterparts, eleven in U.S. universities, resulting in two M.S. degrees (agronomy and animal nutrition), ten B.S. degrees in germaine fields, and three certificates in animal husbandry from Nigeria. All but one participant's training is complete and the other individuals have returned and one on the job. In-country technical training has been constant and extensive at all levels.

3. RANGE MANAGEMENT: Range resource inventorying and vegetation mapping has been completed in 14 Districts of McCarthy Island and Upper River Division, covering 150 species. Livestock Owner Associations there received demonstrated, proved innovations and techniques in range management with the help of trained Pasture Assistants and Range Officers. Four village areas initiated deferred rangeland/crop residue feeding programs which are promising. River access watering development was demonstrated to be feasible and economical.

4. DATA: The Socio-Economic Unit made major contributions to the (forthcoming) Mixed Farming, Livestock and Maize reports, created The Gambia Agricultural Data System and completed a major study on food production/consumption linkages.

5. FORAGE: 362 plants were collected for the herbarium and livestock feeding trials demonstrated that a better use of groundnut hay can be effected by mixture with maize stover.

6. PHOTOMAPS: When finally available these were useful to the range management operation and in other donor projects.

On the other hand, non-results of the project include a complete tested package of forage production technology, a really useful set of land-use maps (but these are available from other projects), substantial research results on integrated maize-forage-livestock village trials, and data analyses of a breadth and depth that would have justified the cost of that component.

B. Lessons

Some project or Gambia-specific lessons and some more general or AID-specific lessons can be assayed. First, it is worthwhile in a project like this to explore at a small-scale, interesting opportunities; this applies to the river access efforts of the range management component, the development of the herbarium whose use in training was demonstrated, and the market news operation. At the same time, intractable problems in the progress of adoption of a proved innovation - in maize production, lack of labor-saving devices and indeed of labor at times can represent serious constraints to further extension. And it was perhaps too optimistic to suppose that a considerable number of integrated village trials could be organized and undertaken in the project's last two years: there can be a point beyond which sophisticated experiments cannot be undertaken broadly readily and in an environment like Gambia's, even with the best of colleagues and field experience.

Second, on a different plain, a lesson of design here is that many good, even unexpected things can come out of a disparate, non-unified project -- so long as its management and sponsors are flexible and realistic. It is necessary to be prepared to adjust, to find targets of opportunity and abandon ineffectual or irrelevant efforts no matter how elegantly they may have been presented and justified years before. It has also been demonstrated here that a concerted effort by dedicated professionals, expatriate and local, can develop and test a production package for a crop not commonly cultivated to farmers' advantage. It is just expensive.

At the same time, project designers may tend to overburden a field-intensive project with crazy, unworkable and essentially useless data collection and analysis requirements -- which also are expensive. This should be left to another except in so far as results support immediate experimental purposes. An elaborate data processing at a home American university with MFP was a disaster but generally would seem to be an unproductive, remote, and unreliable

means to an end. Which is not be say that the AID-Title XII university relationship here has been unproductive or problem best -- even with the Host Country Contracting mode. It would have been better, perhaps, if Collaborative Assistance has been employed, however; wherein the university or consortium competes, after a project's PID approval, for both the design and implementation contract. This can (and in the case of Gambia GARD seems to) bring a closer identification with and knowledge of a project's requirements and pitfalls earlier. And it thus saves time and pain of later adjustment, while establishing initially an identification of purpose and view among the contractor, host government and AID mission.

Finally, it can be difficult to record definitively a project's success, even as it ends and a successor begins. That has to be the case with projects such as this under these conditions. Nevertheless, MFP was able to produce a variety of useful results. Of enduring value are the trained manpower, established techniques, functioning producer organizations, and the maize package and certain surveys and studies. In the larger sense, the project, contract team and government were able to overcome severe obstacles in implementing a somewhat dreamy and highly variegated enterprise: not only delays and interruptions (one cause by the 1981 coup attempt) but also those inherent in technical operations with the rural poor of a country in desperate straits. That the conditions now seem propitious for the successor AID project, GARD, and for similar activities of the GOTG is largely due to MFP. It is regarded by colleagues in the GOTG's Department of Agriculture as the most successful effort of this type in Gambian history.

C. Recommendations

The basic thrust of the Mixed Farming Project was to increase agricultural production and farm incomes by developing a more diversified agriculture. A certain degree of momentum has been achieved. Basic foundations have been established from which continued progress may be reasonably assured. This is particularly true of the maize production and marketing component. Certainly this effort is worthy of continued support, and the techniques involved can be expanded to include other crops as well.

A closely related activity in support of any production and marketing program is that of gathering and analysis of data for monitoring and evaluating degrees of success. Resulting statistics are essential for research, policy determinations, and individual decision making. This activity should be strengthened and expanded to serve a wider range of villager and commercial interests. Data processing and analysis, deserve continued support in the field and in the office. In developing countries it is particularly important to measure impact of a wide variety of costly programs - a computer installation is needed for example. The Mission should consider having SARD assume responsibility for supervising and supporting the computer and statistical gathering system, with FPMU having the opportunity to use the facility when needed, and to turn it over to FPMU when they are able to operate and maintain it.

The top priority of the range component, the program of deferred rangeland/crop residue feeding, should be continued as an on-farm extension demonstration effort if truly valuable results are to obtain. This will require outside donor support. The program is unique in Africa in that it shows promise in the livestock sector of improving the well-being of small farmer/livestock people. Its success is due to the integrated nature of the program. Support of this extension effort must come from research programs to fine-tune the system. A number of range management, forage, livestock production and marketing, and appropriate technology trials are needed.

The number of employees in the Ministry of Agriculture is excessive. Their level of training is low. A considerable number of present employees should be upgraded from the Certificate degree level to that of a B.Sc. A select number of present B.Sc holders must be upgraded with M.Sc level training.

The Mixed Farming Project should be evaluated on the degree to which the interventions they have developed and promoted can be sustained with no or minimal external assistance. The program emphasized primarily the technological packages to "progressive" or "model" farmers and livestock owners, assuming a spread effect. A follow-up evaluation of the longer term acceptance and self-sustaining nature of the MFP implementational thrusts would be very valuable. Three to five years hence would be the appropriate time to assess more profound project impacts and benefits, as is not possible now due to lack of empirical data. This exercize would also assist GAR/Banjul in planning future activities, being informed by evaluation of a major past project which, it seems, will have accomplished far more than anyone had expected.

More specific recommendations to The Gambia follow:

1. Continue maize/fertilizer trials to arrive at recommended nutrient ratio and rates of application according to soil types and other physical constraints

2. Continue research on introduction of adaptable varieties of maize forage grasses, and legumes, and woody forage species. Agronomic evaluation of adaptive species should be developed and trials of grazing, burning, feeding and carrying capacity be continued.

3. Continue seed multiplication efforts, both for maize and forage grasses.

4. Initiate a new national animal nutrition program, using forage legumes as feed for cattle and small ruminants should be initiated.

5. Continue forage legume trials which were somewhat successful and worthy of continuation, and maize/legumes intercropping trials which also show promise.

6. Design a forage agronomist and an animal nutritionist to work together on an integrated development package for forage production and utilization.

7. Adequate efforts to introduce and expand the use of fertilizers, cultivators, shellers and grinders included farm and village demonstrative and other incentives. At this juncture, it appears there are two obstacles to overcome: (a) Most farmers and villagers do not have the purchasing power with which to buy inputs and labor saving devices; and (b) The items introduced are not necesarily the most appropriate for Gambian conditions; for example, the two-row cultivator. Farm credit should be made available to farmers and an agricultural engineer should be assigned to make modifications and improve utility of the cultivator because it should be lighter and more maneuverable.

9. Continue the extension effort directed towards improving livestock production through the deferred rangeland/crop residue feeding program. This must be combined with a major thrust on herd management emphasizing culling. A Rangeland Unit in DAHP should be established to conduct this effort.

10. The photos and negatives produced under the MFP's Component No. 1 should be carefully identified, labelled and stored for use by interested parties. The logical place would be the Forestry Department.

11. With current emphasis upon agricultural diversification and development in The Gambia, the gathering, analysis and publication of accurate information are essential. PPMU has been designated to perform this critical role. MFP was charged to help PPMU develop its capacity at the farm level. To sustain efforts to date, and the important role that PPMU can play, the following should be considered:

    (a) Assigment of a qualified agricultural economist technical to PPMU for a period of three years to assist in implementing the new GADS system and national agricultural data collection. This technician would also provide the needed statistical skills for the improvement of data collection and analysis and the continued training of PPMU personnel in statistics. In addition, he/she would assist in the continued gathering, analysis and broadcasting of market data.

    (b) Assigment of a qualified rural sociologist or anthropologist to PPMU for three years to determine the sociocultural consequences of development interventions and assess whether such interventions are meeting their stated objectives. (The monitoring and evaluative capacity of PPMU is essential for keeping projects and development activities on track.)

    (c) Assignment of qualified data processing/computer expert to assist in the most effective utilization and maintenance of PPMU's computer facility and the further training of PPMU staff in data processing and analysis.

The effectiveness of these assistants will depend upon PPMU's ability to sharpen and narrow its scope of work. Clearer priorities will need to be determined with a regular and respected publication record. Logistical support is needed for PPMU's field personnel to assure timely and accurate data collection and analysis. Logistical support would similarly be needed for office personnel to assure that they can carry out boththeir field and office responsibilities.

ANNEX A

COMPONENT 2

GRAZING AREAS DEVELOPMENT AND MANAGEMENT

A. Objectives

The original project paper describes the purpose of this component of the Mixed Farming Project to be the development and management of grazing areas designed to support improved nutrition of large and small ruminants. It was also to produce basic data necessary for the GOTG to develop resource management and land use policies. It would provide the beginning for improvement of the natural resource base and maintenance of that base at a level capable of sustaining needs of the resource users.

The project paper goes on to say: "Effects of management of renewable natural resources, unlike other aspects of agriculture, are extremely difficult to measure in a short period of time. It is not unreasonable to expect only a little output in terms of grazing land improvement during the first twenty years after start of the project. However, it is important to note that a start must be made for the process to ever reach that point.

The outputs of Phase I will be primarily related to development of a data base from which management strategies may evolve. This data base will contain some quantitative components concerning the ecological inventory, such as annual herbage yield and species composition of various vegetation types, herbage response to various trial plots and species lists of dominant vegetation. In addition, a large body of data from socioeconomic enquiries related to traditional, cultural and social aspects of existing grazing land processes will be developed.

Field training of 4-8 Gambian range management assistants will be well underway by the end of Phase I.

Grazing areas development and management must be approached by an integrated team approach. Many of the activities are dependent upon close collaboration between team members."

Specifically, the project paper called for the following outputs:

DAPPOS DEVELOPMENT:

Ninety percent of all known dappos will be permanently demarcated by markers (pillars). Transport will be provided by the project. DAHP and members of villages and LDA's will set up the pillars.

Long-range planning for rehabilitation and improvement of severely degraded stock routes will be initiated in the fifth year of Phase I.

40-60 deep wells developed in four years.

ECOLOGICAL INVENTORY:

A species list ofall dominant and subdominant plants will be completed.

3 mounted sets of plant specimens will be complete with one set each sent to Smithsonian Museum, Washington, and British Museum, London.

An ecological classification of existing vegetation types will be developed.

200 forage yield samples will be completed and analyzed by the forage nutrition lab. This will be representative of major ecological sites of The Gambia.

Four range management assistants will be trained in basic plant identification, plant yield sampling, vegetation mapping, and collection and preservation of plant materials.

A baseline inventory of existing plant communities and mapping of ecological communities will be 40% complete.

GRAZING LAND MANAGEMENT FORAGE PRODUCTION TRIALS:

Four 10 acre trial plots will be established in 3 ecological types of The Gambia.

Study designs will be developed and at least 2 years of data collected to include the influence of grazing and fire on natural and exotic vegetation.

At least one field day will be conducted at each trial site with villagers brought in for the event.

WOODLAND GRAZING:

An empirical study will be conducted to list the susceptibility of important forest trees to grazing and burning at various stages of growth.

Potential fuel-browse species native to The Gambia will be identified and an analysis of forage quality completed. A small plantation trial plan will be developed.

MANAGEMENT OF GRAZING RESOURCES:

A data base will be developed to describe the traditional methods and ways of grazing management.

Three villages will be identified for grazing manipulation trials in village grazing areas.

A set of year-long forage strategies will be developed with plans for implementing on a limited basis.

Three range management movies from other countries and one set of visual aids explaining principles of grazing land management, forage and feed availabilities, and village level planning and resource allocation will be completed for use by extension and range assistants.

BURNING:

A brush fire prevention information program will be instituted and operational.

TRAINING:

The range management specialist will assist DAHF to develop training plans and will directly supervise training, with guidance from the training and communication specialist, for Gambians recently returned from range management training in Kenya.

The range specialist will work with DAHF to identify an individual or two for B.S. or M.S. degree programs in range management or natural resource management. By the end of Phase II a Gambian counterpart will be ready to assume leadership.

The range specialist will develop simple lesson plans for teaching basic concepts of grazing land management, utilizing trial plots at the various stations to provide hands-on demonstrations of these basic concepts.

The project evaluation of April-May 1983 revised and consolidated the logical framework but it was pointed out that this did not reproduce the original project description or revise it point by point. Rather, the basic thrusts of the project and the essential modifications required to improve its ability to meet the original goal and purpose were set out. Comments that pertain to the grazing areas development and management component are as follows:

Before activities that bring developments in maize and forage agronomy and range management together in integrated mixed farming settings and socio-economic data are brought to bear, a good deal of work must be done that is specific to each production thrust and to the basic collection and analysis of economic and sociological information. In its third year, the project will introduce integrated village trials which bring the packages together in one setting. If successful, these will be continued among larger numbers of villages in the last two years of the project.

The project seeks to improve range management by members of the Livestock Owners' Associations, and has begun to do so with range inventory, range/pasture management demonstration plot trials with 18 LOAs, feeding trials, seed multiplication, and training. These activities will be continued, moving toward investigation of different fallow lands' potential, soil treatment, effects of deferred or controlled grazing, and institutional evolution of the LOAs. Medium-range goals will be: (1) creation of a Pasture Unit in

the DOA, (2) improvement of water availability in selected range lands, and (3) development of the capacity of LOAs to plan and manage their use of local natural resources through use of maps and inventories and better understanding and use of their own and the government's organizations and resources.

Land-use maps at the scales of 1:50,000 and 1:125,000 financed by project funds, but contracted by USAID independent of the project, will become available in 1984. They will be used in the range ecology thrust. It is outside the Mixed Farming Project's competence and essential purpose to deal with national natural resources policy formulation. The project will not support training of map interpreters at the central level. However a set of aerial photographs and land-use maps will be deposited with the GOTG's Surveys Department for future use in national planning.

Ten person-months of short-term technical assistance, or the equivalent, of an animal nutritionist will be provided to assist in refining the technical packages of the forage and range ecology thrusts concerning cattle, and to explore methods of improving small ruminant production.

One long-term participant trainee-ship will be added in range management.

The revised and consolidated logical framework calls for:

1. At least 7 village trials over 3 seasons

2. Three technological and managerial packages, including farm implements, animal and human nutrition.

3. 1:50,000 and 1:125,000 scale land-use maps produced (under a separate USAID contract) and used in range management assistance to LOAs.

Deleted expected outputs were the following:

1. Provide assistance to the GOTG in developing a national land use planning capacity within the MANR which can relate to the problems of both cropland and non-cropland utilization.

2. Provide assistance to the Department of Animal Health and Production in planning and implementing a program of legislated, controlled grazing areas with the necessary stock access routes, firebreaks, forestry shelter belts, and stock-handling facilities.

3. Any reference to developing national land use planning capacity, controlled grazing areas, and demarcation of livestock trials and grazing areas.

Amendment No. 4 to the PROAG says: "Grazing areas development and management is hereby amended by deleting subsections 1, 3 and a

referring to developing national land use planning capacity, controlled grazing areas, and demaraction of livestock trails and grazing areas."

Between November 1983 and March 1984 the MFP team developed an integrated work plan for the final two years of the project. A major effort was made to integrate the activity areas. Integrated village trials were pursued with the following aspects:

Farmers will plant a portion of their cropland to maize using the maize production package. Balance of cropland will be planted to traditional crops, primarily groundnuts (as a cash crop).

Several farmers will be identified to plant forage legumes into an anticipated fallow plot; the legume would be used as hay or pasture during the dry season.

At least one hectare in the proposed 10-hectare protected range area will be used as a forage bank (Stylosanthes hamata).

Corn stover, legume hay and groundnut top hay will be harvested and stored for use as dry season feed.

Corn grain will be harvested to be used as a food crop or sold to local markets.

Livestock will be handled in traditional manner during the rainy season.

An attempt will be made to introduce an unfenced deferred grazing area where local livestock owners achieve the deferment of grazing through group action.

After harvest, crop residues will either be stored in the field (maize stover, sorghum stover, groundnut hay) or near the compound (groundnut hay). These residues and the rangeland are traditionally to feed the livestock over the dry season; the intervention to be introduced is time of feeding to best maximize nutritive value of the feeds.

Socio-economic studies will be conducted of a reconnaissance type and also in relation to the farmers acceptability of technology.

In this context the range ecologist and the forage agronomist had lead responsibilities in maturing a livestock nutrition program, and that program, while concentrated on cattle, would embrace small ruminants as well. Outputs expected from the range management and forage production activity area were as follows:

Recommended program of supplemental feeding and grazing management to provide a year-long adequate nutrition level for livestock.

Feeding trials at village level and on station.

Study of grazing preference among forages by various livestock species.

Organizational and/or technical advice to rural groups initiating self-help water development.

Eighteen dual purpose (demonstration/research) exclosures located in selected rural areas.

Range reseeding trials with both grass and legume species.

Seven field trained, full time Pasture Assistants with an additional five Livestock Inspectors receiving formal classroom instruction only.

Range resource inventories developed for each district in two divisions.

Major study of livestock marketing system, including structure, performance, alternative institutional forms and recommended short and long term strategies for market development.

Recommended set of crop residue management practices for fodder and hay production.

A cost-benefit study of deferred grazing and supplemental feeding practices being developed.

Consultant study on role of small ruminants in Gambian agriculture and possible points for MFP interventions.

Study of decision making and managerial capacity of LOAs.

B. Activities and Accomplishments

1. PRIOR TO MID-TERM EVALUATION

The mid-term evaluation found the range management component to be focusing, correctly so, on bottom-up development with livestock owners' associations and steering clear of politically sensitive issues of water and trail access in national policy. The thrust had been to work closest with farmers in their natural settings. It sought to improve range management by members of the LOAs and had begun to do so with range inventory, range/pasture management demonstration plot trials with 18 LOAs, feeding trials, seed multiplication, and training. The maize, forage and range ecology thrusts had been cooperative in matters of seed production, forage trials, and cattle feeding trials.

Outputs at the time of the mid-term evaluation were assessed as follows but were not incluced in the mid-term evaluation report.

DAPPOS DEVELOPMENT:

The dappo-program is not a high priority to the GOTG. It is politicized, and the RDP I attempted to address it but failed. MFP should not make the same mistake. This issue is not appropriate to be pursued by the MFP.

ECOLOGICAL INVENTORY:

A complete set of 1:10,000 scale positive mylar serial photos is in use to aid the LOAs in planning of local range use. Maps, when delivered in late 1983 will likewise be useful, but it will be premature during the project to proceed to large scale demarcation of grazing areas.

The MFP will use the land classification system of the Forest Inventory Project (West Germany) and the mapping as a base for detailed forage/range inventories.

Aerial photo images were being used to identify and classify land use types. There were to be two series (526 prints) of mylar prints one set with names of towns and geographic places, the other including classification units. There are 13 different land use classification classes possible. MFP maps can be used for plotting of land use, water and trails and as a management tool to give advice to LOAs in two Divisions. MFP uses maps at 1:50,000 and 1:125,000 consistent with other available maps. Soils maps are outdated and new maps are needed.

Sites, and procedures for collecting data have been identified without the aid of the land use classification cartography, which would be available in 1983. The inventory will serve as a collection of biomass data, and DAHP staff will be trained in the collection procedures, computation and basic interpretation of the data. Approximately 39 percent of the land area in MID and URD districts will be covered, the rest will be completed in 1983. The first phase of the inventory considers production followed by measurements in April and May 1983, to determine biomass at that time of the year. LOA members assist in data collection, including local plant names, utility of the plant to livestock and logistical problems of survey personnel. A small herbarium of 100 plants has been developed.

The Crop Protection Services (CPS) and the Regional Food Crop Protection Project has prepared an extensive collection of weeds of The Gambia.

The range component studied and collected biomass in five districts and found a high percentage of unuseable weeds.

GRAZING LAND MANAGEMENT FORAGE PRODUCTION TRIALS:

The widespread practice of retiring arable crop lands to "fallow", when the farmer decides that productivity of crops is unsatisfactory, has resulted in one-third or more of the arable lands being currently in fallow status. Unfortunately fallowing with natural plant growth as the vegetative cover is largely useless. Not only is there scant improvement in the soil's mineral nutrient supplies for plants, but the lands are progressively occupied by undesirable brush and other perennials (a shiny leafed plant with tuberous root is ubiquitous). Such invasion will require costly clearing in the event the fallow is to be restored to cropping.

A highly innovative procedure of reclamation of fallow lands is proceeding under the MFP. The initial step was to introduce improved cultivars of tropical forage species from South America (CIAT, in Colombia) and from Australia, where extensive research has been done in recent years. The first season's field trials of selected species of Stylosanthes have revealed surprising values. In the seedling years of planting these perennials, as much as five metric tons of forage have been produced per hectare. Seed has been produced to be used in further field trials.

It should be noted that this innovative undertaking appears to have far-reaching significance. Should these initial findings be confirmed by more extensive trials on other fallow lands in representative regions, a feasible and highly productive method of reclaiming fallow lands will be available, and the reclamation period will provide highly nutritious livestock feed to support all classes of ruminant livestock. Thus, lands that are not now producing, will be added to the total agricultural systems.

These studies are unique in Gambian agriculture. They will bring the application of available technology from more developed countries into practice in a comparatively short period of a few years. Sustained progress will depend on the success of on-the-job training of Gambian counterparts and assistants and the return of participant trainees who exhibit ability to direct and exploit such research. The project plans call for this essential training.

Eighteen two-hectare demonstration plots have been completed, one in each LOA. One hectare is fenced the other unfenced. Fire lanes were cleared around the plots, two 10 by 20 meter seedbeds were prepared and reseeded, and all shrub material was cleared to ground level. The fenced portion plots were seeded with Cenchrus ciliaris, and Stylosanthes species. Evaluation of seeding will be made at the end of 1983 rainy season.

All 18 plots were installed using volunteer labor from each participating LOA including weeding and seeding. Progress was slow and pasture assistants were asked to rate LOA cooperation as good, fair or poor. The results were: five good, seven fair and six poor. LOAs marked "good" will develop five hectare demonstration plots.

A Peace Corps Volunteer with a degree in veterinary medicine was assigned to DAHP and MFP in April 1983 and has given some assistance to LOAs. He developed a system for DAHP to better identify animal diseases. This effort has virtually ended, due to lack of DAHP interest and support. Animal thermometers and stethoscopes from MFP assisted LOAs to diagnose diseases.

DAHP started several seed multiplication centers in the 1970's in MID. The MFP consolidated these in two plots, the largest in YBK, the other a quarter hectare plot in URD. Both plots have been expanded and will produce Cenchrus ciliaris, Stylosanthes species, and Andropogon gayanus (root transplant), Panicum maximum and Leucaena leucocephala. The plot at YBK will be enlarged to five hectares in 1983. Cultivars used the first year were from The Gambia except the Stylosanthes scabra (Australia). Additional seed was ordered from Australia for seed multiplication in the LOA plots. There is insufficient personnel (pasture attendants) at YBK and URD. A central seed warehouse was established at YBK.

WOODLAND GRAZING:

The Forestry Department is involved in reforestation and management of forest and reserve areas. Each year two villages are selected for their woodlot reforestation program.

MANAGEMENT OF GRAZING RESOURCES:

As a result of the range/pasture component's technical workshop, the LOA Coordinating Committee was established in 1982. The Acting Director of DAHP is the Chairman, and the Committee is composed of all project or technical personnel who are working with or serving the LOAs. The objective of the Committee is to eliminate confusion and create a unified approach to LOA development. The Committee meets once a month, but there is still insufficient participation of the LMB and Divisional supervisors.

LOAs were organized in 1977 through DAHP. Each district has at least one LOA and some have two. There are 36 districts in five Divisions with a total of 43 LOAs. MFP works currently only in two divisions, MID and UFD, because of shortage of trained personnel and the relatively high concentration of livestock and LOAs. There are 20 LOAs with 2,503 members and 60% of the national cattle population in these two districts. In cooperation with DAHP, LOA officers, and commissioners, many meetings were held. LOAs currently are insufficiently organized and structured and are weak in planning and implementation of their own projects. The Socio-Economic Unit should evaluate these in order to better assist them to improve their organization up to the national level and to unify the membership.

Deficiencies in LOAs are the following:

a. No national governing body.

b. Lack of understanding of roles of elected members.

c. No regular meetings.

d. Insufficient membership participation.

e. Inability to monitor money and banking transactions and report to members.

f. Physical size of LOA's land area and distances for members to travel to meeting points.

The USAID/CLUSA program works with LOAs in a numeracy program and assists in improving LOA organization and meeting procedures. Other problems are insufficient water and dry season feed, and inadequate markets to sell older livestock.

Planning is from the field level up rather than from the national level down. The range component is closely working with 18 LOAs in two Divisions. Cooperation from the LOAs has been very good; their members have assisted in developing the grazing trial blocks and the building of firelanes around them. Since only one cropping season has passed it is difficult to assess this component at this time, the exception being Boiram where two years have passed with good cooperation.

The MFP strategy is to develop local agreements with the LOAs through development of a grazing management plan and negotiations in two Divisions. The DAHP will assist the MFP to develop a local district policy. National legislation could not be developed within the life of this project.

The range component needs more office space to place equipment, maps, ecological inventory, two counterparts and the range specialist.

The DAHP has no organized range pasture unit and no efficient extension service.

The MFP recognizes that the livestock components are a necessary and contributing feature of balanced agricultural development. Just as livestock enterprises on rangelands (on non-arable soils) are not a self sufficient activity, so is the production of crops on arable land an unbalanced activity when standing alone. This interaction and integration of both types of enterprise is a necessity for progress in the future development and full utilization of the natural resources of climate, land and soils, adapted plant material and livestock.

The non-arable rangelands of The Gambia, now occupied by native vegetation, are currently over-stocked and over-grazed. The lands and soils have been degraded by sustained over-use, and invaded by useless vegetation. The impervious surface soils have been responsible for large runoff losses of rainfall that should be retained and stored in the soil profile. Only the sandiest soils

have retained their permeability. Based on evidence from other regions, such as the western U.S. and Australia, there appears to be significant potential for restoration of forage producing capability on rangelands by the adoption of suitable technology and materials.

The necessary first steps in the restoration and effective utilization of these lands have been taken in this project. Progress will require successive years of careful management, exploiting those practices that prove most useful. Progress is limited by the life cycles of the cattle (3 to 5 years) that are the important agents for sequential development. Range managers should think in terms of a succession of years to allow time to make beneficial changes. A satisfactory basis has been established for undertaking the restorative process. This must be followed by yearly skillful management to re-establish useful vegetation, to ameliorate the degraded soils, and to learn how to utilized the useful forage by livestock in a manner that will facilitate restoration of the range environment.

The restoration process must involve removal of livestock to other feed sources when the range forage has been depleted to the danger level. The common practice of holding cattle on range with limited forage, which causes excessive losses in live-weight by partial starvation, is unnecessary and self-defeating. Intelligent regulation of grazing on rangelands should become feasible as the present field work yields useful information.

The current rangeland research program has included the reconnaissance of these national resources to determine present status, and the selection of representative areas for detailed studies. In each research site, one section is fenced to exclude or limit grazing, and a companion site is left untreated. The evaluation of introduced forage grasses and forage legumes is being made, as well as selected soil treatments. The vegetative cover of range lands is an important factor in rainfall conservation for continuing plant growth after rains cease.

On the basis of observations on these initial field trials, the usefulness of introducing new forage species in rangelands is to be undertaken. The grazing practices to exploit these improved feed sources without damaging these living forage plants will follow. Other management practices will include the determination of actual live-weight gains or losses under specific local conditions; methods for reducing the present useless range vegetation; the matching of grazing livestock numbers with forage resources, to halt degradation of the range; and the net economic benefits from selected systems of management in terms of livestock offtake.

The cost of maintaining mature marketable animals held on rangelands, thus consuming feed that should sustain growth of younger stock, may be evaluated. Such evaluation will entail determination of benefits from moving the livestock to other feed sources as needed or marketing the excess cattle. The integration of range cattle production with use of forage grown on revegetated

fallow lands, and much more efficient utilization of crop residues (also a project goal), will provide essential integration of the livestock components into more rewarding agricultural production systems.

Forward project planning may emphasize the exploitation of the information acquisition now planned.

The first cycle of livestock feed trials has been completed to determine the yields of crop by-products, their nutritive value when fed to cattle, and the methods of harvesting and storage to fully utilized such feeds. The current season now closing, has revealed unexpected values of the native "gamba" grass when skillfully managed and preserved, as well as the surprising feed value of rice straw when prudently preserved. In addition, the nutritive values of maize and sorghum stovers have been a welcome revelation. The stover is highly palatable when made into silage (with preservatives) in locally constructed trench silos. The values of groundnut hay and stems are encouraging.

The second cycle of feeding trials are now beginning (March 1983) to exploit opportunities disclosed in the preceding year. The apparent effectiveness of these innovative practices should open the door to utilization of available resources that have been largely overlooked in present farming systems. Such feed sources are urgently needed to contribute to feeding cattle after dry ranges have been exhausted. The usefulness of such crop by-products for feeding lactating cows, as well as year-round feed supplies for the family herds of sheep and goats is a promising projection. These studies must be on a yearly cycle, and acceleration will consist largely of full evaluation of each year's results, as a basis for revised studies for the next cycle.

The range forage component will have to work and develop a methodology for range management assistants to determine forage needs of villages. Both components have not yet developed a long-term program at the village level.

There are no information guides or simple illustrations of range management and forage needs at the village level. A year-round strategy was developed in cooperation with the maize/forage component.

Now that one full year of research findings are in hand, the Chief of Party and his staff are finalizing plans for undertaking the initial integration of the livestock components with other components, to test a preliminary integrated farming system. This system will be undertaken with the onset of seasonal rains (about mid-June 1983) to test the feasibility and benefits of proven technology now showing promise. It is intended to evaluate the provisional system further after an additional year (by June 1984) and make such changes in components as seem warranted, and to plan for extension of the tests to other selected regions.

In general, field research should be continued for at least three years, to measure annual variability, and to establish degrees of confidence. The incorporation of useful components into farming systems for practical adoption by farm families may be deemed feasible for extension programs after three to four years, depending on initial profitable field experience in representative areas.

The range/pasture component was requested to assist in developing 175 hectares of forest area with pasture for a holding area to feed LMB purchased cattle before sale to buyers. A half hectare plot was disc plowed, seeded and fenced in July 1981. The seeding was thought to be unsuccessful, but at the end of the second rainy season the stand was found to be well established. Generally, however, reseeding of an area can be expensive and two years go by before it can be grazed. The other alternative is the native species Andropogon gayanus, which can be root-transplanted and produces a useful plant roughly one year after transplanting. The key is not to overgraze and to protect grass from dry season burning and continuous cultivation. Such activities are responsible for declines in range productivity in the URD and MID.

The Livestock Marketing Board (LMB) is under the Ministry of Agriculture and is commercially oriented. The LOAs' coordinating committee was therefore hesitant to invite LMB to participate in the project. The MFP established a trial area of one half hectare in 1981, which was to be expanded to five hectares (new fallow). It would take five years to train a fulltime LMB worker to manage the range/pasture plots.

Range management movies have not yet been produced, because of lack of a total technological package for range management and development and lack of resources of the EAU.

BURNING:

The range ecologist did not burn plots for controlled burning experiments, since they were previously burned. He is studying the immediate and long-term effects of the burning on soils and species.

Insufficient information on bushfire prevention is a constraint and MFF has not yet developed recommendations on this. There are no severe sanctions set by the GOTG for burning, although it is not encouraged by government officials.

TRAINING:

The Range Ecologist arrived in The Gambia in June 1981 and was assigned two counterparts from the DAHF: one of them left to complete a program in range management in the USA. Seven pasture assistants from DAHF were selected; five were posted in MacCarthy Island Division (MID) and two in the Upper River Division (URD).

Each pasture assistant covered three Livestock Owners Associations (LOA). Each pasture assistant was sold on credit a Suzuki 100 motorcycle for mobility. Two additional pasture assistants will be required over the next two years.

The Range Management Specialist will finish his B Sc degree in 1983. One Animal Nutrition Specialist completes his M.Sc degree in 1983. In addition, three participants went for training (two years) to Nigeria to return in 1983. The current counterpart may also be sent to the USA if funds become available.

Counterpart Livestock Inspectors and Pasture Assistants had little or no training in range/pasture management and development. Livestock Inspectors mostly have no high school certificates and undergo fifteen months of training (in-service). The pasture assistants have a high school diploma and serve in a technical and administrative capacity. A training program for Pasture Assistants was held in 1982 and it covered the following subject matter:

a. Monitoring of demonstration plots.

b. Reports on seeding of demonstration plots.

c. Discussion of the annual work plan.

d. Forage biomass rangeland inventory and data collection.

e. Assisting LOA's membership meetings.

f. Collecting, identifying, and classifying forage plant materials for development of a plant library (herbarium).

g. Workshop to discuss joint activities within the LOA areas.

h. Reseeding in range/pasture demonstration plots (18).

i. Expanding stock of plant materials in YBK seed multiplication center.

One counterpart received short term training (three months) in the USA and 34 Pasture Assistants were trained in fence building. Approximately 21 sessions were conducted and a technical workshop was held for 58 DAHF workers. In addition, nine Livestock Inspectors and Pasture Assistants were trained in seedbed preparation. Local training included three workshops in cooperation with DAHF and MFF. The subjects which were discussed were: basic principles of range management, measurement techniques and map reading, and development of an annual workplan. Numerous sessions were held in the field demonstrating vegetation measurement and identification, fencing and reseeding procedures.

The DAHF has a personnel training officer who cooperates with MFF in training of DAHF staff.

2. ' AT END OF PROJECT

DAFFOS DEVELOPMENT:

The dappos development aspect contained in the original project paper was dropped at mid-project when it was stated that the planning and implementation of a program of legislated, controlled grazing areas with the necessary stock access routes, firebreaks, forestry shelter belts, and stock handling facilities would not be continued.

The 40-60 deep wells that were to be developed, as reported in the original project paper, was an error in printing and, in fact, neve was intended to be accomplished.

The mid-term evaluation, however, did add that improvement of water availability was to be accomplished in selected rangelands. Two accessways to The Gambia River were started near Sutukoba (Upper Wuli) and Baraji Kunda (Kantora), both in URD and a third at Sukuta (Niani District) in MID. Shovels, pickaxes and wheelbarrows were furnished for the self-help effort. Completion is expected by May, 1986.

ECOLOGICAL INVENTORY:

The base line range inventory of existing plant communities, completion of a species list of all dominant and subdominant plants, mapping of ecological communities, and development of an ecological classification of existing vegetation types is well underway. This is in spite of the continued delay in consumating a contract, outside of the project's responsibility, for construction of base maps.

Using 1:25,000 scale black and white photos, enhanced from a 1980 set of infared photos, the project has completed field mapping and field inventory of all 14 districts in MID and URD (Table A-2-1). Data collected includes a plant list by genus and species, an estimation of percent ground cover by plant species or litter, and a measurement of plant green weight by species. These green weights were later adjusted for percent moisture and recorded as percent dry matter on the basis of 153 forage yield samples collected and air dried. Data collection points had been pre-determined within preliminary vegetation type designations done in the office. At each data collection point in the field a site identification description was made, land use classified, land treatment indicated, soil erosion rated, and the nearest stock water source identified and its distance determined. Editing of the 1,322 data point writeups is presently underway and a computer program is being prepared to assist with storing and analysis of the data. Preparation of maps from the aerial photos is just beginning by the project due to the lack of availability of the promised base maps. Total numbered plant specimens in the herbarium identified to species are 362. Plants have been collected, dried, mounted,

identified, and labeled. There are over 150 different species or varieties of dicots and over 90 monocots. Some 150 specimens are being sent to KEW Botanical Gardens to be included in their African collection.

A total of 22 range forage samples have been collected during field inventory and have been analyzed for dry matter and crude protein. These include grasses, forbs, shrubs, trees, maize, sorghum and millet. An additional 40 samples are awaiting analysis.

Seven Pasture Assistants, each responsible for three LOAs have been involved in the ecological inventory work and trained in basic plant identification, plant yield sampling, vegetation mapping, and collection and preservation of plant materials.

GRAZING LAND MANAGEMENT FORAGE PRODUCTION TRIALS:

The YBK Range Seed Multiplication Center was expanded from 3.3 hectares to 6.6 hectares in 1985. Six hectares are currently under cultivation producing Cenchrus ciliaris (Buffel grass), Andropogon gayanus var. bisquamulatus ("Wea" or Gamba grass), Penicum maximum (Guinea grass), Stylosanthes hamata (Verano legume), and a Leucaena sp.

Stylosanthes scabra (Seca stylo), a tall (1 meter) evergreen perennial legume was found to be susceptible to infestation by termites. Being the only green plant material in an otherwise dry annual vegetative environment, termites ate the green roots so extensively that the plant falls over and dies, sometimes before seeds mature. As a result seed plots at both YBK and Giroba Kunda have been eliminated and replaced with other plant material.

The Giroba Kunda Range Seed Multiplication Center, near Basse, remains at 1.2 hectares. Guinea grass, though growing rapidly from seed and producing quantities of viable seed, cannot withstand drought. Each rainy season the perennial grass had to be resown. After three seasons of resowing in July, harvesting seeds in November/December, only to have the grass die over the nine month dry season, Guinea grass and seca stylo have been eliminated and the emphasis now is on Andropogon gayanus and Cenchrus ciliaris.

Transplanting of the Gamba grass into designated deferred range plots as well as in 1 hectare range demonstration plots has been done over the last three years, always during August, the peak rainfall month. For the first time, in 1985, all plant materials came from the Range Seed Multiplication Centers at Giroba Kunda and YBK, and not from Yundum International Airport, near Banjul. Areas where transplanting has been accomplished are:

Deferred range plots:
Boiram (Fulladu West, MID)
Piniai/Choya (Niamina West, MID)
Sukuta (Niani, MID)
One hectare range demonstration plots:

TABLE A-2-1: Range Inventory Data Collection by Year

YEAR DATA COLLECTED	DISTRICT	DIV.	HECTARES **	NUMBERS Writeups (Samples)
1982	Niamina Dankunku	MID	13,030	27
1982	Niamina West	MID	14,310	36
1982	Niamina East	MID	31,690	91
1982	Wuli (2)	URD	53,730	195
1983	Kantora	URD	33,075	66
1983	1/2 Fulladu East (3)	URD	40,365	80
1984	1/2 Fulladu East	URD	40,365	85
1984	Sandu	URD	32,985	101
*1985	Sami	MID	46,865	134
*1985	Fulladu West (2)	MID	79,055	188
*1985	MacCarthy Island***	MID	1,165	13
*1985	Niani	MID	42,455	105
*1985	Nianija	MID	12,010	53
*1985	Upper Saloum	MID	27,760	87
*1985	Lower Saloum	MID	16,985	61
4 seasons Oct-Jan	14 districts (18 adm. Units)	2	485,845	1,322

* Two data collection mobile teams

** Areas quoted in Land Resource Study 22

*** MacCarthy Island District was overlooked in previous reports.

(2) Two sub-districts

(3) Three sub-districts

Njau (Upper Saloum, MID)
Kumbal (Kantora, URD)
Jar Kunda (Lower Wuli, URD)
ITC Solo Site (Fulladu West, MID)

Seedings have been accomplished in the areas shown in Table A-2-2.

A seeding of Stylosanthes hamata, Cenchrus ciliaris, Andropogon gayanus, Panicum maximum, and Chloris gayanus was accomplished on a Livestock Marketing Board holding ground at Kabakora (Foni Bintang Karenai, Western Division) in June 1981.

Difficulties were encountered in getting busy farmers to weed the seeded Gamba grass. Young seedlings must be weeded within the first 4 weeks following emergence in order to survive. Heavier than normal rainfall in 1985 increased on-farm labor requirements, leaving less time for off-farm work. The same labor constraints were experienced in trying to transplant additional Gamba grass in the three deferred range plots. Additional stocks of root material were available both at YEK and Giroba Kunda, but farmers were unwilling to furnish the voluntary labor necessary to do the transplanting. The Jahally/Pacharr Rice schemed has tied up labor from the Boiram area. There is little surplus labor available during the month of August.

Deferred range plots established by MFP are as follows:

Finiai/Choya (Niamina West, MID) - 15.25 hectares in 3 parcels
Makama Sireh (Upper Wuli, URD) - 10 hectares in 2 parcels
Sukuta (Niani, MID) - 13.27 hectares in 2 parcels
Boiram (Fulladu West, MID) - 10 hectares in one parcel

It should be pointed out that these deferred range plots were established primarily as extension demonstration areas to be used as tools to convince farmers of the importance of reserving range forage for the dry season. They are also used to show the value of that deferred forage with time as better forage plants become established through natural succession when grazing use is not excessive and fire is controlled. In addition they show the value of introduced forage plants along with native plant species. The plots were not intended as sites for detailed data gathering for the sake of research. Data has been collected, however, that would enable an analysis of the effects of fire exclusion (or less frequent fires in one case), the effects of delaying season of grazing, and the effects of rate of grazing (approximately 1/2 of the range forage produced remained at the end of the year, as compared to no forage remaining outside the plots).

Field days have been conducted at each trial site with villagers brought in for the event. In 1985 approximately 25 farmers were bussed to a one day visit of the Giroba Kunda Range Seed Multiplication Center near Basse. Also in 1985, approximately 35 farmers were bussed to the YEK Range Seed Multiplication Center. Following on the same day they visited the Boiram, as well as the

Table A-2-2. Reseeding of range forage species in deferred range plots and in one hectare range demonstration plots.

Location	Species Planted				
	Andropogon gayanus	Cenchrus ciliaris	Stylosanthes hamata	Stylosanthes guianensis	Stylosanthes scabra
One ha. range demo. plots:					
Kumbal (Kantora, URD)		X	X	X	X
Kundan (Fulladu East, URD)	X	X	X	X	X
Sabi (Fulladu East, URD)		X	X	X	X
Karantaba Tucular (Sami, MID)	X	X	X		
Sambatako (Fulladu West, MID)	X	X	X		
Sare Ngai (Fulladu West, MID)	X	X	X	X	
Maunda Kunda (Niamina East, MID)		X	X		
Balanghar (Lower Saban, MID)	X	X			
Charnen (Nianiji, MID)	X	X	X		
Njau (Upper Saloum, MID)	X	X	X		X
Dankunku (Niamina Dankunku, MID)		X	X	X	
Konko Duma (Sami, MID)	X				
Deferred range plots:					
Makama Sireh (Upper Wuli, URD)	X	X	X		X
Piniai/Choya (Niamina West, MID)	X	X	X		
Sukuta (Niani, MID)	X	X			X
Boiram (Fulladu West, MID)	no seedling survival				

Finlai/Choya, deferred range/crop residue feed programs. A field tour was also conducted at the Yundum feeding trials. Select farmers, one from each LOA in MID and URD, were brought in to review this work.

The most significant extension program has been the five years of daily contact that Pasture Assistants, Range Officers and the Range Specialist of MFP have had with farmers. These technicians are an extremely dedicated group of people who have positively responded to the field level needs of MFP.

WOODLAND GRAZING:

No studies have been conducted by the project on the susceptibility of important forest trees to grazing and burning at various stages of growth. No potential fuel-browse species native to The Gambia have been identified and, therefore, no analysis of forage quality completed on these species. A trial plan for a small plantation of potential fuel-browse species does not exist.

MANAGEMENT OF GRAZING RESOURCES:

Of the total 19 LOAs in MID and URD, the range program has successful programs in 17 LOAs. A year-long forage strategy has been developed by the project and implemented on a limited basis as pilot extension demonstration areas. Four villages have participated in grazing manipulation demonstration trials in village areas.

The deferred range/crop residue feeding programs implemented in Boiram/Njoben, Finlai/Choya, Sukuta, and Makama Sireh will be continued starting in March/April, 1986. This program is implemented by groups of livestockmen from more than one village. Deferred range areas are 10-15 hectares. Heifers (1-3 yrs) are the animals fed maize stover for one to two months (February-March) on a feed-lot basis, after which animals are turned onto the deferred range for 2 months (April-May). Groundnut hay, rice straw, or sorghum stover is fed in June. A total of 48 stockmen have participated in the program.

Another crop residue feeding program is being implemented by stockmen in individual villages. The collected residues are stored in small fenced plots located in the vicinity of the village. Farmers work collectively to store residues on platforms. The recommendation is to supplement heifer diets during the last 6-8 weeks of the dry season, and before adequate green material is available early in the rainy season. Emphasis is on storing maize stover and rice straw, primarily because neither has been utilized as a harvested animal feed. Although used to some extent for grazing, both are permitted to either rot in the field (maize stover) or be burned to remove it from the fields (rice straw). MFP recommends that participating farmers use the stored residues to feed heifers. In actuality some older cows, draft animals, and small ruminants are also being offered the stored residue.

In 1985 nine village storage units were constructed by participating stockmen using fencing materials provided by MFP. An estimated 28,063 kilograms of crop residue were stored and a known 139 heifers were fed, all in Wuli and Kantora Districts of URD.

The 1986 program includes the original nine participating villages plus an additional 28 (Table A-2-3).

The 1985 program has been left exclusively to individual Pasture Assistants to organize and assist stockmen with implementation (Table A-2-4). The favorable success of the program implemented in 1985 is reflected in the fact that M.M. Jobe retained all nine 1985 units plus an additional 6 units in 1986.. The first year is one of demonstrating to the farmer the effects of feeding maize stover and rice straw to animals late in the dry season when range forage is very minimal. All heifers fed in 1985 survived the 8 weeks famine period. Many that depended on open range alone died before adequate quantities of green plant material was available on the range. Individual initiatives taken by Pasture Assistants are an important key in how the farmers percieve collecting, storing, and later feeding residues to hungry livestock. The Pasture Assistants with two or more units in Table A-2-4 are those actively involved in the crop residue program, reseedings, and assisting farmers in the management of deferred range plots.

A data base has been developed and a report is presently in preparation on a herding study conducted by the forage agronomy team and individuals from PPMU.

Range management movies from other countries and a set of visual aids explaining principles of grazing land management, forage and feed availabilities, and village level planning and resource allocation have not been acquired by the project for use in The Gambia. The project has completed one video program explaining all aspects of the MFP project. The Extension Aids Unit of the Ministry of Agriculture has prepared a similiar 16mm movie.

BURNING:

A brush fire prevention information program has not been instituted by the project.

TRAINING:

The range management specialist has very successfully accomplished the outputs called for in the project paper under training. He has assisted with training plans and directly supervised on-the-job training for his counterparts who returned from training in Kenya prior to the MFP. He has identified individuals for long term training who will be or already are back in The Gambia, capable of assuming leadership. He has developed lesson plans for teaching basic concepts of grazing land management, utilizing trial plots at the various stations to provice hands-on demonstrations of these basic concepts. He has gone beyond the requirements listed in the project paper by training a number of Pasture Assistants and has

Table A-2-3.

List of Villages Participating in
"1986 Supplemental Feeding Program"

MACCARTHY ISLAND DIVISION

Fulladu West District:	Sare Ngai
	Njoben
	Alulaye
	Fass
	Sare Buti
Niamina West District:	Ba Kunda
	Nana/Dalaba
Sami District:	Konko Duma
Niani District:	Kuntaur Fulla Kunda
Nianija District:	Buduk
Nianija District:	Wellingara/Sinchou Omar
	Bakadagy

UPPER RIVER DIVISION:

Upper Wuli District:	*Kunjur/Taborkoto
	*Wellingara/Madina
	*Koli Kunda
	*Sutukoba (2)
	Brifu
	Tabanding
Kantora District:	*Baraji Kunda
	*Garawol
	*Sudawol
	*Kusumuh
	Quena (Koina) (2)
	Kantale Kunda
	Geba
Fulladu East District:	Kundam

Note: Sabi (URD, Fulladu East District) has yet to install the fenced storage area and cannot seem to collectively agree to gather residues. Kumbul (URD, Kantora) was unable to complete a storage facility. Fencing was removed and moved to Gaba.

* 1985 Program

TABLE A-2-4. Implementation of Village Supplementary Feeding Programs By Pasture Assistants

NAME	DISTRICT	UNITS
Momodou Jobe	(Wuli/Kantora)	15 units
Omar Jammeh	(Fulladu East)	1 unit
Momodou Fofana	(Niani)	1 unit
Malang Sanneh	(Fulladu West)	5 units
Demba Manneh	(Sami)	1 unit
Seddy Fatty	(Nianija)	3 units
Lamin Jallow	(Niaminas)	2 units
	TOTAL	28 units

helped conduct numerous field days and tours for farmers. Details of all of this training can be found in this report under the section on Component 6: Agricultural Skills Trainirg And Communication.

The range management component has been involved heavily in integrated village trials to bring the various packages of MFP together in one setting.

Although attempts have been made by the project, no Pasture Unit has been created in the DOA or in DAHP.

Short-term consultancy assistance was provided to determine the importance of and possible methods of improving small ruminant production.

C. Major Findings

The integrated program of deferred rangeland grazing areas/crop residue feeding/maize production package implemented by MFP hints at the probability of a high degree of success at reaching project goals: increasing the economic well-being of the people of The Gambia. This is particularly encouraging for the range livestock sector when past efforts in Africa have met with difficulties. The key to the success of the MFP in The Gambia is due to the linking of key activities in both the agricultural and livestock sectors. As with any young program, however, there is a good deal of fine-tuning needed.

The range livestock/forage agronomy program is, like its Gambian executors, schooled in principles but needing time and opportunity to try what it knows. In that process a good deal of trial and error is necessary. At the same time a number of obstacles are forseeable, allowing the acquisition of solutions prior to implementation, thus avoiding unnecessary setbacks. The program desperately needs assistance, undoubtedly from outside The Gambia, to allow this fine-tuning to take place, allowing graduation with magna cum laude.

WATER DEVELOPMENT:

Any effort to encourage the deferred use, or lighter use, of rangelands requires that the livestock owner be supplied some incentive to get into a program he is unsure of. Water development, being among the top priority wants/needs of African livestock owners, can be one of those incentives. The Gambia has the unique opportunity to provide that incentive at relatively low monetary cost and possibly at low or no ecological cost.

River access point development, as conducted by the MFP, is low in cost to the donor when all labor is provided by livestock owners. Ecological disturbance is minimal because it is simply improving an access point already presently in use and not developing an

additional water source around which degradation will occur and because of which livestock numbers usually expand. Livestock have a unique ability to survive on closer and more convenient water supplies even in the absence of forage following overgrazing. In the absence of a marketing economy (as opposed to an economy of money on the hoof), livestock numbers expand with additional water point development. At the same time as river access point development is encouraged as part of an incentive package, the consequences of possible increases in livestock numbers must be closely monitored and the program curtailed if livestock numbers outgrow the carrying capacity of the forage resource.

Simultaneously, then, programs building on MFP must quickly and thoroughly study and develop a program to encourage livestock marketing. Even though the deferred grazing/crop residue feeding program encourages the sale of old, unproductive animals and the feeding of young, productive animals, the majority of livestock owners still prefer to feed the old and sick in hopes of maintaining maximum animal numbers.

ECOLOGICAL INVENTORY:

The herbarium developed by MFP is a valuable resource for training field personnel in plant identification, so necessary for the analysis and management of rangeland resources. It is of high quality with specimens well labelled, cataloged, and preserved. The collection must remain with the, as yet undesignated, Rangeland Unit within DAHP. Its practical consequences for livestock production far outweigh its relationship to the plant sciences, namely agronomy.

The range inventory and mapping exercises were very valuable experiences for several reasons. It has provided baseline information on specific points within MID and URD which allows assessment of current conditions but most importantly will allow future assessment of trends in vegetation with land use. Secondly it has been an intensive training exercise for Pasture Assistants and Range Officers.

The mapping exercise, although very time consuming, has provided future extension demonstration efforts with a basis upon which to determine the location of future activity. Grazing areas are now identified along with major routes for livestock movement, access to river water, and fallow and active cropland. In the process, areas have been identified which have high potential for improvement. In the future, when village level management programs are requested and attempted, information will exist to guide these efforts. Mapping will then need to be expanded in detail for the specific land units concerned. The mapping exercise has also provided field officers with a basic knowledge of mapping techniques but, more importantly, familiarized the workers with their assigned areas.

GRAZING LAND MANAGEMENT FORAGE PRODUCTION TRIALS:

The two seed multiplication centers supported by MFP are indispensable at this point in development. They are the only local

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source of seed for seeding programs conducted on deferred range plots, on the one hectare range demonstration plots, or on other areas requested by farmers/livestockmen. They also serve as valuable demonstration plots, not necessarily for seed production, but for their forage production and quality potentials.

Several issues are of concern. First is the limited number of species tested for present or future production. It is important to point out at this point, however, that the emphasis of the program was one of demonstrating proven innovations and techniques. This the program has commendably done. Under their current charge, the MFF decided that elaborate testing of other materials would dilute the time available for extension activity. Those species chosen have proven very successful. While they are now being pushed there needs to be an on-going program of search and selection for other promising species. An example of the need is the Boiram area where seeding of these species was unsuccessful, although this may have been due to the drought conditions of 1982-84.

The second issue is one of questioning who should be involved in the various stages of plant material breeding, testing, multiplication and release. Experience in other parts of the world, both developed and developing, is that many aspects of this process, important for economic development, are better handled if put in the hands of the private sector. The program needs to study this industry and identify individual progressive farmers and industries interested in pursuing this market. Extension programs need to be developed for growers and marketing personnel.

Thirdly, grazing preference trials have been limited to one season on forage legumes at three locations. Preference trials were carried out on two of the four deferred range plots; the one at Sukuta and Makamasseri. Cenchrus ciliaris, Andropogon gayanus, Stylosanthes scabra, and Stylosanthes hamata were the introduced species observed. Utilization was measured rather than time spent grazing each species. These trials were implemented during the late dry season of 1985. Given the tremendous labor requirements of transplanting Andropogon versus seeding Cenchrus, the desirability of each species in different locations, at different seasons, and by various classes of livestock would provide valuable guidance to recommendations made. Performance of animals grazing must be followed as well.

Fourthly, since labor supply has been a significant factor in farmers being able to plant a forage they clearly see the advantages of, work needs to be done on various techniques of establishment. These may include burning, grazing, interseeding with chemicals or use of appropriate equipment, i.e. animal traction

WOODLAND GRAZING:

Woody species can be a very valuable forage resource, especially in a long dry season as experienced in The Gambia where forage is predominantly annual grasses extremely low in protein during the last four months of the dry season. Woody species should be

included in all of the forage production trials discussed above. Of considerable importance is the management and expansion of the native Acacia albida, a nitrogen fixing tree dormant in the rainy season and producing valuable forage (leaves and pods) in the dry season.

MANAGEMENT OF GRAZING RESOURCES:

This aspect of the range livestock/forage production sector is the most promising element of the sector and possibly the project because of its innovative, integrated nature. All other activities conducted by this sector should play supportive roles to this crucial, on-farm, applied extension demonstration trial aspect. It is the ballerina ready to dance!

The development of deferred range/crop residue feeding programs is particularly crucial in light of the loss of grazing along the Gambia River where rice development is taking place.

The location of decision making and the composition of the deferred range/crop residue feeding program participants is a question in implementation of the program. The range component has found the LOA too large to work with, since it is on a district basis. These programs must be organized at the village level. What then becomes of the LOA and what decision making organization takes its place at the village level? Efforts to date have been with more progressive farmers, sometimes combining progressive farmers from several villages. Will the program be accepted by villages as a whole?

Fencing is an expensive proposition but at this point absolutely essential in the minds of the farmers/livestockmen in the program. It is a psychological barrier, if nothing else, that reminds and encourages participants to keep fire out of the area and utilize the forage as suggested. Can other types of fencing be employed, i.e., movable electric fencing? Will the program expand to adjacent villages and thus eliminate the need for internal fencing, village use boundaries demarked only by surface markers? Will the "mental fence", that of acceptance and self-enforcing of the program, prevail? Will herding in the dry season, a practice not traditionally conducted, replace the need for fencing?

The labor question arises again. Is labor going to be available for expanding seedings/plantings, fire protection, herding, etc?

These questions can only be answered by continuing to support an effort that has at least an outward appearance of promising success. The forthcoming herding study of MFF may shed some light on some of these questions.

Technical refinements may be in order. Further experience is needed to determine the optimal time the various feed components are fed in the last four months of the dry season. The longer the native or introduced grass species stand as "cured" hay the lower its quality becomes. Maize stover, groundnut hay or other residue, once stored bundled together or staked, may lose its value slower. Should the

deferred grazing areas be used first and stover/hay fed last? Less effort may be expended by animals during the hottest, driest months in this manner. Or should a combination of two or all be fed for the entire four month period? Studies need to be conducted to sort out these questions.

A material needs to be identified for construction of the stover/hay storage racks. Frequent replacement due to termite damage will lead to extensive forest cutting.

At the same time that burning is being prevented from occurring on the deferred areas as a demonstration of the value of this forage in the late dry season, it must be remembered that many of these ecosystems are dependant upon at least occassional fire to prevent the dominance by undesirable woody plants. A fire prevention program of an extension nature needs to accompany the deferred rangeland/crop residue feeding program but it must include the concept of the value of occassional but planned burning in order to aid in the range improvement effort.

The encroachment of undesirable species might also be controlled by the use of goat grazing at certain times of the year, in combination with a cattle grazing and burning program.

TRAINING:

The number of trained personnel dealing with range and crop residue programs in MID and URD is probably sufficient. Their level of training, however, must continue to be upgraded. The Pasture Assistants must continue to be provided with organized in-service training courses in aspects of range management, livestock production, agronomy, and marketing. The Range Officers are competent field technicians capable of conducting various technical exercises. They have had neither the training nor the experience to plan and conduct a comprehensive range management/livestock production program for all of The Gambia. Their training must be upgraded, after a period of practical experience in The Gambia, by M.S. degree trainng empnasizing extension planning and livestock forage balancing.

This cadre of trained professionals must continue to push for the creation of a Rangeland Unit within DAHP and financial support for that Unit from the Gambian Government.

D. Recommendations

In light of the encouraging long-term probability of success of the range livestock/forage agronomy component of the MFP towards increasing the economic well-being of farmer/livestock people in The Gambia, the following recommendations are made for future activity in this sector.

1. Continue, with outside support, the deferred range/crop residue feeding, on-farm, applied, extension demonstration trial program.

2. Mount an extensive program of herd management which emphasizes culling.

3. Establish a Rangeland Unit in DAHP with Gambian financial support.

4. Upgrade training of existing Pasture Assistants and Range Officers.

5. Fine-tune the deferred range/crop residue feeding program with applied, on-farm research trials. Many of these topics are best handled though regional research programs since solutions will be useful to more than just The Gambia. These trials concern:

   a. effect of river access points on livestock populations;

   b. grass, forb, shrub, and tree adaptability trials;

   c. livestock preference and performance trials on these adapted forage species;

   d. techniques of establishing these adapted species on rangelands;

   e. low cost methods of fencing - can herding replace fencing?

   f. feeding trials to determine optimum time for various feeds involved in the forage balancing program;

   g. low cost materials for feed storage racks to avoid deforestation;

   h. the place of fire and small ruminant grazing in the forage management program for cattle.

6. Work towards encouraging the private sector to take over the majority of the seed production efforts for range forage species.

7. Continue to expand the range herbarium in the control of a Rangeland Unit within DAHP.

8. Conduct range inventories and mapping at the stage of planning village level deferred range/crop residue feeding programs.

ANNEX B

COMPONENT 3

IMPROVED CROP AND FORAGE PRODUCTION AND MANAGEMENT PROGRAM

A. Maize

OVERVIEW:

The most important and basic objective spelled out in this original component was to develop a technological package to improve maize production as human food and feed for cattle. Specific objectives were; to expand testing maize cultivars at research stations; to conduct trials on date of planting, fertilizer responses, plant densities; to plan and develop a maize seed multiplication program; introduce maize shellers and impart training in its use; to determine efficient utilization of maize stover as live stock feed; and to train Agricultural Assistants (AA's) and Agricultural Demonstrators (ADs) to deliver technolcgical packages to farmers through Mixed Farming Centers (MFC's).

The Early Mid Term Evaluation of MFP in 1983 indicated that results from the maize package should be carefully studied before proceeding with its commercialization and further recommended (1) continued research to refine the maize technological package in terms of intercropping, soil management and use of storage; (2) development of a long-term seed multiplication plan; (3) addition of technical work in nutritional terms on maize as fodder; (4) adaptive research on cultivation implements; and (5) technical assistance to promote on farm maize consumption for human nutrition.

The technological package, containing date of planting for a selected cultivar (NCB) with recommended plant density and rates of fertilizer application, has been made available by the MFP. Plans for seed multiplication of a recommended variety (NCB) were developed; maize shellers and mills were procured and distributed for demonstration; improved harvesting, storage and feeding trials on maize stover as animal feed have been achieved; and, a sufficient number of AAs and ADs have been trained to conduct and demonstrate the production package to farmers. MFP also trained one senior officer, one maize agronomist and two Gambians at the B.S. level majoring in Agronomy. These personnel were able to carry out the original package and were able to introduce most of the recommendations made by the Early Mid-term Evaluation to make improvements in maize production technology. This major success can be attributed to their concentrated efforts and skill in gathering available information from the DOA, making use of the Maize Growers Association, getting a fair price for maize approved by the government, organizing 'Nafo's' and their representation in the farmer's cooperatives, and last but most important, teaching and convincing farmers that maize is an important food and cash crop.

Thus, MFP was very successful in preparing a tested maize production package technology and delivering it to The Gambian farmers. Most DOA and DAHP administrators and MFP counterparts have commended this success. Further, its success is also demonstrated by the increase in maize area from about 2,600 hectares at the beginning of the project to 18,000 hectares by end of 1985 . The average national yield has increased from 1.6 t/ha to 2.5 t/ha and there is a significant increase in number of maize growing farmers. (Tech. Rpt. No. 3 by Kidman and Owens). The production and food preparation training to several women's societies (40-70) was fairly successful and had an impact on adaptation and increased production of maize. Women have learned to produce maize as a field crop, consume maize flour in a number of recipes, improve their family diets, and to sell surplus maize when the price is high (Tech. Rpt. No. 4 by Marlett and Sambu).

SPECIFIC OBSERVATIONS:

Impact of the Project on Adaptation of New Technology

Adaptation of maize as a field crop has established maize both as food as well as a cash crop for farmers. Farmers are are using maize as a food crop and as a replacement for expensive rice. Because of these factors, it is becoming an alternate crop to groundnuts and cotton, especially in MID (MaCarthy Island Division) and URD (Upper River Division) of the country. Use of maize as food and training to over 40 women societies in preparing several kinds of food recipes from maise flour has increased diversity in the human diet and improves nutrition and health of villagers.

Another important impact was to train the National Maize Grower's Association, in seeking help to obtain fertilizers and other inputs from Cooperative Societies, and bargain for an adequate price for maize from the government. It may institutionalize a seed multiplication program for maize as well as for other cereal crops. The "Kafos" or growers associations have also become a good tool for extension and similar activities carried out by DOA, DAHP and/or other government agencies.

Production Constraints:

There are several constraints that tend to restrict benefits from the maize program. An important one is the lack of suitable labor saving devices for plowing, harvesting, transporting (stover and grain), processing stover, grain storage, grain shelling and milling. Another very important constraint is cost of fertilizers and delays in delivering supplies in time for planting. Fertilizer prices are basically high and continuing to rise. Farmers are very poor and cannot afford a major expense, nor do they have a proper credit system so that they can buy the fertilizer at the time of planting. Most Gambian soils are sandy or sandy loam and, without fertilizer applications, maize production cannot compete with sorghum, millet and particularly groundnuts. Late delivery of fertilizers is also a problem.

Migration of young people from villages to cities has created labor shortages. Thus, weed control in maize is becoming a serious problem. Inter cropping technology is still not perfected to realize benefits of planting legumes in maize.

To overcome these constraints the provision of adequate credit systems to solve most of the problems related to production inputs is recommended. However, better use of animal manures, development of local technology to make most equipment, and research on herbicide use to control weeds may provide relief to farmers. Supply of subsidized fertilizers and seeds for the initial 2-3 years, to build a financial base, may be required. Production of high quality seed on DOA farms or a premium price to seed growers, and a competitive maize grain price in comparison to groundnuts may alleviate most of the constraints. Several other suggestions are: to design and introduce locally made cheap intercultural implements (ex. one blade harrow); continue varietal trials to select best forage types and high grain yielding varieties; application of pre-emerge herbicide (ex. primagram); encouraging farmers to select their own seed from the best looking cobs; float the maize price; and stop the maize movement across borders of The Gambia. (See details in Recommendation Section).

Training and Use of AAs and ADs

MFP provided financial support as well as expertise to annual in-service training of AAs and ADs. The training was conducted by the training Unit of DOA. Over 100 AAs and about 300 ADs were trained at Agricultural Stations. The MFP participated in these programs and thus a sufficient number of AAs and ADs were trained particularly to serve the maize program of MFP.

The training of AAs, ADs and project personnel was provided on a short term basis. According to the maize agronomist, about 50% of them joined the program just to get on the job and thus were unable to pass the technology on to farmers effectively. These trainees were either incapable, should have been trained at Gambia College, or should be re-trained. Also, since, they were employed by DOA, they should be re-tested to hold their jobs. MFP also organized several workshops, field days for farmers, training for village extension workers, maize cooking demonstrations, and training for staff of all five divisions of the country.

Impact on the Ministry of Agriculture

It would have been helpful to have more research bulletins prepared on all project components and some extension leaflets for the use of extension workers and/or farmers. The project increased the mobility of extension staff by providing motorcycles to extension supervisors and bicycles to village extension workers. MFP also delivered a production package to the department's field stations for farmers, particularly for maize, range management and, to some extent, for forage improvement. The project improved soil testing by installing equipment and obtaining chemicals and fertilizer supplies. The MFP increased the capacity of the extension service through conducting field days and helping in the organization of maize growers associations.

The maize production technology package

The MFP annual report of 1983-84 indicates the following components of the maize technology package:

1. The use of good quality seed, variety NCB;

2. Timeliness in carrying out the essential cultural practices/operations including weed control and earthing;

3. The use of 11Okg N and 4okg P_2O_5 per hectare, with N being applied in split-applications; and

4. Conservation of stover for dry season livestock feed.

Trials were conducted on ½ hectares of 156 farm fields in 65 villages. Results showed a significant increase in yield (1.6 T/ha. to 2.5 T/ha.) over traditional methods of planting maize. Maize planted areas have also increased significantly over the last two years. Maize area of 2,600 hectares reported in 1983 has been estimated to be 10,000 hectares in 1984 and 18,000 hectares in 1985 as has been reported by the maize agronomist in his 1985 October report.

Introduction of the maize cultivator was a partial success. It prepares more land but it is heavy, very expensive and must be pulled by relatively large oxen in comparison to indigenous ploughs. Successful demonstrations of cutting and storing maize stovers immediately after harvesting have been shown. About nine grain storage structures were built and drying of early harvested maize has been demonstrated. Several maize shellers and grain mills were installed for the 'Kafos'; and they have been readily accepted but their cost may be prohibitive.

Fertilizer and Plant Density Trials

Based on soil tests (Appendix B-3-4) every year, several fertilizer trials were conducted (Appendix B-3-5) at all MFP centers. These trials were coordinated with FAO's Fertilizer For Food Program. Response to fertilizer elements in sandy and heavy rainfall areas in West Gambia was very poor, mainly due to leaching. Based on these trials and government policy, 110kg N and 45kg P_2O_5/ha was recommended. One third of this N and entire amount of P_2O_5 should be broadcast and worked into the soil at planting time. Four weeks later, at the time of the second weeding, the remaining two thirds of N should be applied along the rows and then earthed up to cover the fertilizer. However, based on the current high price of fertilizers and potash response in over 80% of the FAO-trials, the recommendation in rate of application has been changed to 76 kg N, 30 kg P_2O_5 and 30 kg K_2O per hectare. An application of 200 kg/ha of 15-15-15 at planting time and 100kg/ha of urea after four weeks of planting can meet this new recommendation.

Plant Density Trials

The MFP maize agronomist has been recommending planting of maize at 90 cm X 30 cm based on their 1984 trial. His trial of 75 cm X 30 cm gave higher yields (data not available), however, and therefore this will be the new recommendation. A systematic plant density trial with final plant population (counted at harvesting time) has not been done. Therefore further trials are needed to determine the optimum plant density/ha to obtain maximum yields.

MFP's maize agronomist planted a nonreplicated intercropping trials of maize with groundnuts, maize with cowpeas and maize with Dolichos lablab. According to the maize agronomist (data and report being prepared) for grain and seed yield, maize with groundnuts gave the best yield. However, for soil conservation and for more forage production, maize with lablab was best.

Maize Cultivar Testing

Maize cultivar testing trial, have been conducted since 1975 by DOA and later coordinated by MFP. A brief review of these trials (Appendix B-3-6 and B-3-7) showed that from eight to 22 cultivars have been included in tests conducted at Yundum, Sapu, Jenoi and at MFP centers. Promising cultivars from ITTA, Sahel and CIMMYT were included in these trials but none was better than JEKA and NCB; and the latter was consistently better than all others. Therefore, NCB was selected as a recommended variety for the maize production package with JEKA as a good companion cultivar.

More recently, five exotic materials of flour maize from CIMMYT were tested (Appendix B-3-7) for their yield and adaptability at Yundum. The results are very promising from two crosses (8121 and 8043) which significantly yielded better than Pool 16, a cultivar already in the pipeline for release to farmers. MFP has done relatively few variety trials. The crop improvement section in DOA has conducted most of the cultivar trials every year at Sapu.

Maize Seed Improvement and Multiplication

Seed multiplication for maize was planned and tried in 1982 by supplying foundation seed of NCB cultivar to plant 33 hectares on 'Kafo' farms. However, because of food requirements at home and the low price offered by GPMB, this seed was not available. In 1984, two hectares of foundation seed were planted in February for multiplication on irrigated land. This effort produced about 10 tons of excellent quality seed. In June 1984, about 50 farmers were given part of this seed to plant one hectare each. About 100 tons of seed were produced by these farmers and the seed was bought by DOA at a prefered price. It was a definite success. However, due to a rapid increase in area planted under maize, this was not enough to meet even one-half of the need. But since NCB is an open pollinated variety, farmers can replace seed once in three or four years and the maize program can continue even with this shortage of quality seed. However, if maize hectarage keeps growing, adequacy of genetically pure certified seed production may need serious consideration.

Introduction and Training in Use of Maize Shellers and Grinders

Maize must be shelled and then pounded or milled into flour. Hand shelling of maize is a difficult task and that may be the reason that it has been grown only as a compound crop, roasted to eat and finished before the grain dries the on cob. To overcome this difficulty, MFP introduced 30 hand shellers and 39 hand mills among 'Kafo' members and maize growing societies of Gambian women. These shellers and mills were well accepted. But shellers are too small and mills are hard to operate. Still the latter ones are more acceptable in comparison to the diesel mills introduced by the FAO, which requires expensive fuel and spare parts. The cost and market

availability of shellers and mills are still prohibitive for an average farmer. Thus, shelling and milling of grain still remains a serious problem for Gambian women.

B. Forages

OVERVIEW:

The second basic element emphasized in the original design of the Mixed Farming Project was to initiate a forage program by introducing exotic tropical grass and legume species for use on fallow lands; promote better use of groundnut hay; extend dry season grazing; evaluate crop residues and promising legumes through feeding and grazing trials; multiply seed of suitable and adapted grass and legume species with the seed multiplication unit at Sapu; and train Gambian animal husbandry specialists in forage improvement and develop a forage technological package. The MFP's Early Mid-Term Evaluation of 1983 suggested that these basic research efforts should continue. It also recommended addressing a few additional subjects such as (1) the land allocation and tenure system as it affects the adoption of the forage production package; (2) the utility of forage banks; (3) labor application and techniques, including farm implements, to convert forage land into cultivated land; and (4) livestock (including small-ruminants) nutrition.

During the two years (mid 1981 through late 1983) the work of MFP's forage agronomist was right on target. Several legumes were introduced from Australia, CIAT and other sources. Trials on locally available promising grasses and adaptable legumes were initiated. The MFP forage agronomist in cooperation with the range specialist, promoted better use of crop residues through improved harvesting, storage, and feeding of maize and sorghum stovers, and groundnut hay. Livestock feeding trials and chemical analysis of crop residues were conducted. Better utilization of groundnut hay was achieved by mixing with maize stover for feeding to prevent weight loss in ruminants. Enough seed was multiplied (at Sapu) and was harvested from promising adapted legume accessions, to plant forage nursery plots during the 1984 season.

Two persons, (both from DOA) started their training as Gambian counterparts with the forage agronomist. These counterparts were trained to play an active role in extending technical training to several AAs and ADs as well as to aid in extension activities of agriculture and animal production and, assist in the development of a forage curriculum for training of AA's at Gambia College. These counterparts were then sent to U.S. Universities for higher level training. Also, based on two years of observations and results of trials, a year-round plan for cattle grazing, and a feeding program to maintain adequate nutrition/body weight were recommended. (Appendix B-3-1). In addition to these achievements several other forage related studies to develop a forage production package were proposed for 1984 and 1985 project years (Tech. Rpt. No. 2 by Hedrick and Bojang).

Seed multiplication of adapted legumes/grasses for dry matter, yields and conduct grazing and feeding trials and work on commonly cultivated legume crops for intercropping with the maize agronomist were conducted.

As expressed by most DOA and DAHP administrators and MFP counterparts, the project was unable to deliver a tested package on forage production technology for farmers.

SPECIFIC OBSERVATIIONS:

Use of maize stover through improved harvesting and storage has the potential to provide feed for animals during the end of the dry season. Farmers can realize improved good health and nutrition for their animals which in turn increases their value for sale, milk and draft. Use of legumes (groundnuts, cowpeas, etc.) in intercropping with maize, improves land use efficiency and diversifies farming by increasing food and feed production. Intercropping with legumes will also extend the growing season and reduce the quantity of N-fertilizer used.

MFP provided fencing, water troughs and access routes to the river, and feeding pens at the Farmyard Yundum.

Maize Stover as Livestock Feed

Since 1982, maize stover feeding trials have been conducted by the forage unit (Appendix B-3-2 and B-3-3). Stovers were harvested soon after removing the ears and stacked to preserve green color and leaves and to avoid bleaching from the sun. The stovers were fed alone or in combination with other dry grass or groundnut hay. Results from comparative trials showed that gamba grass when fed unchopped was less preferred to maize stover; however, animal performance (gain in weight) was not significantly different. Both the grass and the maize stover were inferior to groundnut hay. A mixture of groundnut hay with chopped maize stover was the best combination for nutrition as well as to maintain body weight. Thus, early harvested maize stover proved to be an important livestock feed for the latter part of the dry season. An added value results from saving more groundnut hay for traditionally prefered animals such as horses, donkeys and oxen.

Improved Forage Species in The Gambia

Dr. Hedrick formulated a program that contained adapted and potentially valuable legumes to alleviate shortage of dry season forage supplies. He integrated work on potential but adapted forage grasses with the Range Ecology and Management Programme. Thus forage agronomy work on grasses and legumes started in 1982 on tillable lands. A literature search of previous work on introduced forage species was conducted by Dr. Russo.

Introduced Cultivars of Forage Legume Species

The forage agronomist obtained seed of 15 promising cultivars of legumes from CIAT, ILCA and other sources (Appendix b-3-8). In 1982/84 evaluation plots were established at Yundum, Sapu and YBK stations (Appendix B-3-9) representing three major soil associations in The Gambia. The list of these introduced legumes is shown in Appendix B-3-9. Three species of Stylosanthes (s. humilis, s. hamata, s. scabra) and two bush type legumes, Leucaena leucocephala and aeschynomene histrix, were established satisfactorily. The comparative performance of these legumes conducted at three locations (Appendix B-3-10) showed that stands and yield were more uniform at YBK than Sapu and Yundum. But CIAT accessions at Yundum out performed others by nearly two to one. It appears that the potential of stylo species at all locations is promising whereas Leucaena may adapt well in Sapu and YBK areas of the country.

Potential of Introduced Legumes to Extend Dry Season Grazing of Fallow Lands

Based on stand establishment during the past four years, it seems that four of the introduced legumes have potential to extend dry season grazing on fallow lands. Three of the stylo (s. humilis, s. hamata and s. scabra) species for all regions and one Leucaena up-country have shown good adaptation on DOA stations; however, at most of the NFC stations their performance has been very poor. Poor supervision, lack of care and untimely management during 1984 and 1985 years of the project were the main reasons for these failures. Simulated grazing (frequent cutting trials) were conducted to determine forage yield and dry matter production at four and six week dipping intervals on over one dozen legume species at three locations. Grazing trials were also conducted to determine palatibility. Demonstrations were done in the villages in three of the deferred range plot and ten one ha. range demonstration plots. Leucaena, if planted four meter apart can produce forage for small ruminants with two or three rows of maize in between the Leucaena rows. However, it was not demonstrated because of caterpillar damage in 1985. Stylosantheses scabra stays green even in the late dry season and can be adapted for range on marginal lands as can be seen on the YBK station in rangeland plots.

During a visit to legume forage plots at Yundum, it was mentioned that a series of grazing trials were conducted and visual observations shows that S. hamata and S. humilis were most prefered by animals.

Attempts were made to develop a seed production program for adapted legumes at Sapu. Stylosanthes and other legumes were planted in two hectares. However, quantity of seed produced has been limited.

Feeding Trials Conducted on Crop Residues

Livestock in The Gambia are fed or grazed on crop residue for four to five months out of six to eight months of dry season. The importance and use of crop residue can further be noted in Appendix B-3-11. In 1982, the MFP forage agronomist made silage from both maize and sorghum and fed the animals at Yundum. The silage was found to be palatable and nutritious to both young and older animals; however, since silage making requires heavy machinery for harvesting, chopping and making of silage pits, it was considered uneconomical for farmers.

Livestock feeding trials on crop residues were conducted during 1982 and 1983. Maize, sorghum and gamba grass residues were harvested, stacked and stored with improved techniques. Residues of rice straw during both years and groundnut hay in 1982 were obtained from farmers. The analysis of crop residues were made at Abuko (Appendix B-3-12) and feeding trials were conducted at Yundum (Appendix J1 - 5). Crop residue analysis indicated that some groundnut hay mixed with the stovers would probably prevent weight losses that otherwise occur. All feeds used in the trial groundnut hay, gamba grass hay, rice straw, maize and sorghum stovers proved to be valuable dry season forages. All residues except two stovers enabled two-year old and one-year old heifers to maintain their weights for a period of one month to six weeks. In feeding trials of maize, whole straw versus chopped straw (in 10cm lengths) it was observed that only 50% by weight of whole straw and 70% of the chopped straw were eaten by two year old heifers. However, sorghum's chopped straw was eaten only about 50% in comparison to much less than that of the whole straw.

In management practices it was observed that maize stalks were of high quality if cut as soon as the mature ears were harvested and stacked in bundles on end instead of flat on the ground to dry. Similarly, in the case of groundnut hay, it is best to cut the tops leaving about 20 cm of the stem base (for later lifting of the nuts), dry for two to three days after placing into windrows and stack them on polyethylene. This practice has produced much better quality hay in comparison to hay gathered by traditionally farmers.

During 1984 and 1985, several feeding trails were conducted mainly with four feed mixtures containing 50% of each feed (maize stover and groundnut hay, sorghum stover and groundnut hay and only groundnut hay) and gamba grass or sorghum stover with 5 kg/head of groundnut cake in 1983. It has also been mentioned that in some trials, groundnut hay was replaced with stylo hay. Most of the feeds used in these trials were analysed for their nutritive value (Appendix B-3-13). All the crop residue or feeds, except groundnut hay, are quite low in crude protein content. Groundnut cake (not a forage but a concentrate) is very high in protein and available in limited quantity in the Banjul area only. In most 1984 and 1985 trials, animals maintained weight. In 1985 trials where groundnut cake was used, the animals gained on an average of 230 gm/day in 2 out of 3 trials. Among the feed mixtures, as expected, the maximum weight gain and rate of daily intake was with groundnut hay, and daily intake of maize stover was the lowest. It can be concluded that mixing of the various crop residues with groundnut hay appears to be an excellent way to increase crude protein content in rations and to maintain animal body weights. Instead of hay or in case of its shortage, groundnut cake if, available, can be mixed with other crop residues in the Banjul area. Improved methods of harvesting, storage and feeding practices on crop residues were not extended to village sites.

Gambian Animal Husbandry Specialists' training

MFP trained three AA's, two B.S. level (Bojang and Jallow) persons in forage agronomy, and one M.S. level (M.B. M'Boob) in animal nutrition.

C. Recommendations

Based on this evaluation and to further promote forage and maize production and for the well being of the people of The Gambia, the following recommendations are submitted:

A. FORAGE PROGRAM:

1. During the last five years, MFP has put a considerable amount of effort in to the introduction and evaluation of forage legumes. It is recommended that more exotic and tropical forage legumes be introduced, trials conducted on their adaptation, and agronomic evaluations be continued.

2. Multiply seeds of promising legumes to establish a nursery and extend the areas under forage on fallow lands.

3. From the existing available information a package for animal feeding on forage legumes and crop residues should be developed and enforced. For the success of such a package and to make further improvements, it is recommended that forage agronomists and animal nutritionists work as an integrated team.

4. Since the principal aim of a forage production program is to improve animal production or maintain their body weights, it is recommended that a National Animal Nutrition program for evaluating and feeding forage legumes be undertaken.

B. MAIZE PROGRAM:

1. Since MFP has successfully developed and extended a maize production package it is recommended that the package activities should be maintained to achieve self sufficiency in production of cereal crops.

2. To make continuous improvements in the maize production package, it is recommended that:

   (a) Based on suitability of soil and rainfall patterns most desirable maize growing regions be classified, or established.
   (b) A dual purpose variety (high grain yielding and of quality stover) should be selected through continuous cultivar testing trials in each region.

   (c) Based on soil tests, and two or three year fertilizer response trials analyzed in terms of economic returns, fertilizer recommendations be prepared for each region.

   (d) Because of the sandy nature of soils, response of split N applications in three equal quantities (at planting, 3-4 and 7-8 weeks after planting) should be determined.

   (e) Suitable techniques must be developed to apply and make high quality farm manure from animal droppings. It will increase soil fertility, soil moisture retention and reduce the quantity of expensive fertilizer used.

   (f) Maize should be planted as soon as possible with the on-set of the rains. There is no need to conduct trials on planting dates. However, an optimum plant population for each soil type or region must be determined.

   (g) For each maize growing region, an integrated crop protection (control of insects, rodents, termites, etc.) program should be developed.

3. A rapid increase in area and production of maize will require production of genetically pure and quality tested certified seed. It is strongly recommended that either DCA's seed multiplication farms produce seed, or private seed companies with assured premium price be established. At least one functioning National Seed Laboratory should be built and equipped or existing facilities upgraded and used.

4. It is recommended that inter-cropping with an optimum ratio of maize and legumes (i.e. groundnuts, guar, bambara nuts, mung beans, cowpeas, etc.) be developed as a package. This will

help to reduce use of N-fertilizer, suppress weeds, produce more than one crop, supply balanced residues for dry season feeding and will conserve soil as well as moisture.

5. For balanced cereal production and for mono-culture maize, develop a three or five year rotation (maize-groundnut-maize-cotton or millet or sorghum). This will improve soil conditions, minimise specific insects, weeds or diseases and diversify farming to meet several household needs.

6. It is recommended to devise methods to harvest high quality stover, and develop its transportation, storage and chopping to mix with legume hay to feed animals.

7. MFP's cultivator was useful but it is too heavy and expensive. It is therefore recommended that it be modified by an agricultural engineer to retain the two row seeding mechanism but make it lighter and more maneuverable and cheaper. A two row seeding mechanism can be attached on its main frame with a furrow opening device just behind the bar. If this proves impractical, it may be replaced with a simple U-shaped one blade cultivator allowing soil to pass over and penetrate 5-10cm in to the soil.

8. A way should be found to reduce the price to farmers maize shellers. Similarly a modified version of coffee grinders to grind maize for each family or a large stone grinder operated by animal power should be tested in villages.

TABLE B-1

Year-Around Forage Supply to
Optimize Nutritional Intake

Wet Season	
July 1 - October 31	Bush grazing which provides an adequate diet through December.
Dry Season	
Nov. 1 - December 31	Continue grazing the bush as indicated.
Jan. 1 - February 28	Feed lower quality residues from cropland such as maize and sorghum stovers while bush grazing continues.
Mar. 1 - June 30	Feed heavily on legume fallows and add more nutritive crop residues, such as groundnut hay and rice straw as needed.

TABLE B-2

Summary of Feeding Costs and Animal Gains for a 63 Day Feeding Period

Item		Group A (Groundnut Hay only)	Group B (Groundnut Hay and Maize
1.	Initial weight (kg./animal)	188.8	207.5
2.	Final weight (kg/animal)	211.3	258.8
3.	Total gain (kg/animal)	22.5	51.3
4.	Weekly gain (kg/animal)	2.5	5.7
5.	Daily gain (kg/animal)	0.36	0.81
6.	Groundnut hay consumed:		
	a. Total (kg/animal over 63 dys)	317.1	224.0
	b. Daily (kg/animal)	5.03	3.56
7.	Maize grain consumed:		
	a. Total (kg/animal over 73 dys)	-	181.4
	b. Daily (kg/animal)	-	2.88
8.	Cost for 63 days feeding		
	a. Groundnut hay* Dalasis/animal)	D31.70	D22.40
	b. Maize** (Dalasis/animal)	-	D70.75
	c. Total feed costs	D31.70	D93.15
9.	Cost per kilogram of weight gain	D1.42	D1.82
10.	Value of weight gain***	D44.10	D100.56
11.	Ratio of Benefit to Cost of Feed Alone	1.39	1.08

* At an assumed price of D100/ton
** At GFMB price of D370/ton
*** Eight bulls were purchased for the trial at an average liveweight price of D1.9e/kg. This price was used.

NOTE: Labor and costs other than feeds nominally associated with animal feeding were not taken into consideration in this feeding trial.

TABLE B-3

J-1: Intake of forages by four animals from 11-1-82 to 6-2-82.

TYPE OF FORAGE USED	AMOUNT OFFERED (KGS)	RESIDUES (KGS)	DIFFERENCE (KGS)	AMOUNT (PERCENT)
Stover	874.3	383.2	501.1	57
Gamba Grass Hay	671.5	341.9	429.6	49
Trad. Groundnut Hay	701.1	104.3	596.8	85
Good quality G/nut hay	689.1	14.3	674.9	98

J-2: Average intake for forages in kilograms.

FORAGE	DAILY INTAKE FOUR ANIMALS	INTAKE ANIMAL	KGS/100KGS WEIGHT
Stover	17.9	4.4	1.7
Gamba grass	11.8	3.5	1.4
Trad. groundnut hay	21.3	5.3	2.0
Good quality G/nut hay	24.1	6.0	2.4

J-3: Ranking of forages as to intake, 1 = lowest, 4 = highest.

FORAGE	AVERAGE DAILY INTAKE	PERCENT USED	INTAKE/100 KGS. WEIGHT
Stover	2	2	2
Gamba grass	1	1	1
Trad. Groundnut hay	3	3	3
Good quality G/nut hay	4	4	4

J-4: Rank of forages based on animal gain or loss in kilograms.

FORAGE	AVG. GAIN OR LOSS/ANIMAL	RANKING (1=lowest, 4=highest gain)		
Stover	-6.3	1		
Gamba grass	-2.5	2	loss	N.S.
Trad. Groundnut hay	11.3	3		
Good groundnut hay	12.5	4	gain	N.S.

J-5: Intake of Crop residues in Kgs and percent of forage offered with associated weight changes of four animals in 38 days - February 2 to March 11, 1983.

RATION	KGS. OFFERED	KGS. EATEN	PERCENT USE	WEIGHT CHANGES
Corn Stover	696.2	475.0	68	-45kgs/4 animals
Sorghum stover	853.1	416.1	48	-30kgs/4 animals
Groundnut hay	694.0	651.5	94	+20kgs/4 animals
Rice straw	694.2	631.3	91	-15kgs/4 animals

TABLE B-4
Soils Laboratory, Yundum
Physical and Chemical Characteristics of
Mixed Farming Center Soils

MIXED FARMING CENTER	pH	SAND	SILT %	CLAY	CA	MG/ 100g	K	SOIL TEXTURE [1]
Wellingara	5.50	80.10	11.50	8.40	1.47	0.72	0.10	SL
Jambanjelly	5.10	88.08	6.80	5.12	0.85	0.35	0.15	LS
Pirang	5.90	86.08	11.92	2.00	1.21	0.38	0.09	LS
Somita	5.90	86.24	7.76	6.00	1.17	0.54	0.17	LS
Kanjibat	4.20	80.24	10.72	9.04	0.41	0.44	0.14	SL
Jibanack	6.20	84.88	6.00	9.12	1.05	0.40	0.47	SL
Kwinella	5.25	73.00	13.00	14.00	1.55	0.81	0.38	SL
Jenio	5.50	89.68	6.08	4.24	0.98	0.67	0.16	LS
Jasong	5.75	81.46	12.78	5.76	0.74	0.61	0.22	LS
Karantaba	5.25	86.08	8.32	5.60	0.68	0.50	0.17	LS
Bakendik	5.65	90.00	5.00	5.00	1.12	0.63	0.14	LS
Yallal	5.70	87.00	4.00	9.00	0.85	0.39	0.09	LS
Njabakd	5.00	88.00	10.00	7.00	0.51	0.30	0.07	SL
Ngainsanjal	4.80	78.88	13.80	7.32	0.78	0.62	0.11	SL
Njau	4.60	80.40	15.28	4.32	0.57	0.46	0.09	SL
Kuntaur	5.00	72.43	10.66	8.00	0.91	0.66	0.13	SL
Dankunku	5.35	91.36	8.64	6.60	1.70	1.06	0.94	LS
Mamutfana	6.75	76.00	15.00	9.00	2.02	0.14	0.38	SL
Sare Ngai	5.25	92.00	1.00	7.00	0.88	0.22	0.31	LS
Sare Sofi	6.00	84.00	6.00	10.00	1.52	0.74	0.19	SL
Mankama	5.75	86.00	10.00	4.00	1.41	0.57	0.51	LS
Giroba	4.10	84.00	9.20	6.80	0.32	0.32	0.06	LS
Fatoto	4.70	88.24	6.76	5.00	0.46	0.87	0.21	LS
Jah Kunda	5.00	83.00	10.00	7.00	0.78	0.44	0.33	LS
Nauda	4.80	72.88	16.00	11.12	0.93	0.77	0.24	SL

[1]SL = Sandy Loam
LS = Loamy Sand

TABLE B-5
Combined Results of 58 Fertilizer Rate Trials on Maize
Source: 1981/82, 1982/83 and 1983/84

Treatment kg/ha N, P_2O_5, K_2	Country Average Yield [kg/ha]	Yield Increase [kg/ha]	Gross Profit [d/ha]	Cost of Fertilizer [d/ha] S	NS	Net Profit [d/ha] S	NS	Benefit: Cost Ratio S	NS
60-0-0	1582								
60-40-40	1860	279	108	52	83	56	25	2.08	1.30
60-0-40	2517	935	365	70	112	295	253	5.21	3.26
60-40-0	2540	958	374	90	144	284	230	4.15	2.60
60-40-40	2917	1335	521	106	169	415	352	4.92	3.08
120-40-40	2847	1265	493	160	256	333	237	3.09	1.93
60-80-40	2708	1126	439	142	227	297	212	3.08	1.93
60-40-80	2486	904	353	122	195	231	158	2.89	1.81
MEAN	2132	972				Significant at 1%			

Standard error of a difference ± 170 kg/ha.
Less significant difference 5% - 516 kg/ha. 1% - 714 kg/ha.
Coefficient of variation 13 -79%

SOURCE: Report on the Agro-Economic Interpretation of 3 years trial work on Maize, Millet and Groundnuts in The Gambia. FAO Program, Cape St. Mary.

S = Subsidized price
NS = Not subsidized

TABLE B-6

A Review of Maize Cultivar Testing Trails at Different Locations in The Gambia

LOCATION	VARIETY	TRIAL YEAR	TRIAL PLACEMENT	YIELD Kg/ha.
Yundum	NCB	1975	8th of 22 varieties	2,205
	Jeka	1975	-	-
Yundum	NCB	1976	5th of 12 varieties	3,370
	Jeka	1976	2nd of 12 "	3,562
Yundum	NCB	1977	3rd of 12 varieties	3,102
	Jeka	1977	5th of 12 "	2,932
Yundum	NCB	1977	1st of 19 varieties	3,040
	Jeka	1977	8th of 19 "	2,793
Sapu	NCB	1978	1st of 17 varieties	4,783
	Jeka	1978	2nd of 17 "	4,698
Yundum	NCB	1981	3rd of 12 varieties	4,200
Sapu	NCB	1981	4th of 12 varieties	3,500
	Jeka	1981	3rd of 12 "	4,100
Yundum	Jeka	1982	3rd of 8 varieties	3,714
Jenoi	NCB	1982	5th of 8 varieties	2,869

(NOTE: Missing data for years not listed above are due to high CV's caused by drought or fungus disease, according to experimental reports.)

TABLE B-7

Performance of Soft Maize (flour maize)
Cultivars Tested During 1985 at Two Locations in The Gambia

	LOCATIONS	
CULTIVARS	SAFU (kg/ha)	YUNDUM (kg/ha)
Across 7434	3.47[2]	3.59
Across 8043	3.42	3.15
Across 9121	3.46	2.93
TZB	3.05	3.40
ZM - 10	4.13	3.71
Pool - 16 (check)	4.26	3.69
C.V, %	10.7	10.6
Lsd.05	0.8	0.77

1. Data supplied by Maize MFP Agronomist, Mr. Solomon Owens

2. Means are not separated by DNMRT. Use Lsd.05 for statistical significance.

TABLE B-8

Stylosanthes Accessions in The Gambia, from Various Sources.

Species	Australia ? At YBK pre-81	A & CIAT July '82	(ILCA) July '83	(CIAT) 1984
St. capita		1315	(10280) Capica 1019 1728	2013
St. guianensis	(Cook?)	A-Cook	Schofield Endeavour 136 1283	184 RSK 1020 tardio
ST. hamata	(Verano?)	local A-Verano 118	147	147
St. humilis	(Gordon) (Lawson) (Patterson)	local		
St. macrocephala		2093		2039
St. sympodialis		1044		
St. scabra		A-Seca 1047		

Numbers are CIAT accessions. Names are cultivars from CSIRO Australis (A), and except that Schofield and Endeavour were obtained from North Nigeria, and Capica is the first CIAT release.

TABLE B-9

List of Legume Introduction Plots at Three Locations in The Gambia

SPECIES	Location YUNDUM	SAPU	YBK
Stylosanthes humilis-local	x	x	x
Stylosanthes hamata-Australis	x	x	x
Stylosanthes hamata-local	x	x	x
Stylosanthes hamata-ILCA	x		
Stylosanthes scabra-Australia	x	x	x
Stylosanthes guianensis-Australia	x	x	x
Stylosanthes guianensis-cv. Endeavor	x		
Stylosanthes guianensis-cv. Schofielc	x		
Stylosanthes guianensis-CIAT	x		
Stylosanthes macrocephala-ILCA	x		
Stylosanthes capita-ILCA	x		
Stylosanthes capica-CIAT	x		
Aeschynomene histrix	x	x	x
Macroptilium atropurpurem	x	x	
Leucaena leucocephala-Australis	x	x	x
Leucaena leucocephala-local	x	x	x
Leucaena leucocephala-Philippines	x	x	x

APPENDIX B-3-10

Comparative Yields of Legume Cultivars

at Yundum, Sapu and YBK

	Grams/m^2					
ACCESSIONS	YUNDUM		SAPU		YBK	
Stylosanthes humilis	846.5		296.0		399.0	
S. guianensis	308.0		70.5		803.0	
S. hamata - Australia	7.0		207.5		608.0	
S. hamata local	81.0		450.0		391.0	
S. scabra - Australis	3.0		169.5		301.5	
TOTAL	1246.0		1194.0		2503.0	
MEAN	249.2		238.8		502.2	
Metric tons/hectare	2.5		2.4		5.0	
CIAT accessions						
Aeschynomene histrix	263.0					
S. hamata	668.0	Avg.	450.5	Avg.	391.5	Avg.
S. sympodialist	515.0	6.2		3.1		3.5
S. scabra	580.5	t/ha	169.5	t/ha	301.5	t/ha
TOTAL	2026.5					
MEAN	506.6					
Metric tons/ha	5.1					
Three Leucaena Accessions						
LE - P	Insufficient		15.5		90.5	
LE - A	for Harvest		33.0		86.0	
LE - L			22.5		6.0	
TOTAL			71.0		182.5	
MEAN			23.7		60.8	
Tons/ha			0.2		0.6	

TABLE B-11

Number of Hectares of Each Major Crop Grown in The Gambia* and the Estimated Forage Value of Residue for Cattle. Animal-Unit-Month is Equivalent to 180 Kilograms of Usable Residue Required by One Adult Weighing 280 Kilograms.

Crop	Number of Hectares	Yield Per Hectare Metric Tons (1000 kg)	Percent Usable	Usable Crop Residue Metric Tons	Animal-Unit-Month Grazing Value
Groundnuts	95000	1.5	95	135375	752000
Sorghum	16300	2.0	50	16300	90555
Maize	9500	3.0	50	14250	79166
Swamp rice	22800	1.5**	90	30780	171000
Upland rice	4200	1.0	90	3780	21000
TOTALS				245610	1113721***

* Source: PPMU

** Estimate obtained by dividing irrigated rice straw yields by 2.

*** Figure must be divided by months of feeding to obtain number of adult cattle these residues will support, e.g.,

$$\frac{1,113,721 \text{ AMU's}}{6 \text{ months}} = 185,620 \text{ animals} \qquad \frac{1,113,721 \text{ AUM's}}{4 \text{ months}} = 278,430 \text{ animals}$$

TABLE B-12

Analyses of Crop Residues Used in 1983 Feeding Trials
With Two-year Old and One-year Old Heifers from
Yundum Livestock Herd

Name of Feedstuff	Crude Protein	Crude Fiber	Ash Content
Groundnut hay	11.9	24.4	6.3
Rice straw - January 1983 Sapu	4.4	28.2	20.8
Gamba grass hay	4.0	36.5	4.5
Maize stover	3.1	37.1	7.5
Sorghum stover	1.7	33.9	6.2
Maize silage	3.5	32.0	6.0
Sorghum silage	4.4	27.8	6.6
Rice straw - short variety April 1983 Sapu	2.8	32.5	

Analyses completed in Department of Animal Health Lab at Abuko.

TABLE B-13

Analyses of Crop Residues Used in Trials 85-1, 85-2, 85-

Feed-stuff	DM	Ash	Pro-tein	Ether Extract	NDF	ADF	Cellu-lose	Lignin*
G.G.	95.5	4.4	1.8	n.a.	78.7	45.7	39.2	6.5
G.H.	94.8	8.5	11.6	n.a.	47.5	36.7	26.3	10.4
M.S.	97.5	41.4	2.9	n.a.	49.2	29.7	22.8	6.9
S.S.	96.2	10.6	3.1	n.a.	71.7	45.2	35.4	9.8
S.H.	95.?	10.2	4.2	n.a.	73.6	57.3	40.5	16.8
G.C.	95.3	4.3	52.2	5.6	20.4	13.4	10.5	2.9
G.D.	95.8	16.9	11.5	4.3	55.8	44.6	29.5	15.1

G.G. - Gamba grass
G.H. - Groundnut hay
M.S. - Maize stover
S.S. - Sorghum stover
S.H. - Stylo hay
G.C. - Groundnut cake
G.D. - Groundnut dust

n.a. - not available
Analyses done at University of Sweden, Uppsala

ANNEX C

COMPONENT 5
STRENGTHENING MINISTRY PLANNING AND EVALUATION CAPACITY

INTRODUCTION

The purpose of this component was to establish within the Ministry of Agriculture and Natural Resources (MANR) (which since the beginning of the project was divided into the Ministry of Agriculture (MOA) and the Ministry of Water, and Environment) to do ex ante project planning and ex post evaluation. It was envisioned that the Socio-Economic Unit (SEU) would perform the following four functions:

1. Descriptive Function: The SEU was to provide information of a quantitative and qualitative nature describing and analyzing the livestock and land use systems operating in The Gambia.

2. Testing Function: The Unit was to test at the field level the particular technological packages developed by the project in order to assess their relevancy to the local Gambian farmers and testing the potential of the institutions or exogenous factors serving the livestock producers to provide the necessary incentive and support to increase their level of economic well-being and to ensure an equitable distribution of that well being.

3. Monitoring Function: The Unit was to monitor changes over time as a result of project interventions in order to ascertain if the packages and/or strategies proceeded as anticipated or whether some modifications were necessary; and to assess the impact of the project and therefore provide a base for its evaluation.

4. Training Function: The Unit was to build up a core of Gambians with a micro socio-economic orientation in the Ministry of Agriculture.

The activities of the SEU were mapped out for years one and two with greater flexibility for the rest of the project. However, the baseline study to be conducted in project year one was to be repeated in project year five. The original project paper emphasized that the activities laid out were not a complete program but rather to be modified by the results from previous years work. The mechanism suggested to ensure the coordination of the SEU to the needs over the project were extended planning sessions to be held every six months to discuss and agree on an overall work plan. The project paper suggested relatively wide participation in these planning meetings.

AID was to finance five person years of an agricultural/livestock economist and one rural sociologist and short-term technical services of a marketing economist. Other personnel were to be Gambian counterparts who would receive both on the job and formal training.

Planned Activities: - Over the life of the project, the SEU was to undertake the following:

1. A Baseline Survey in years one and five to determine the characteristics of The Gambian farming systems in which livestock are incorporated and to tentatively indicate the constraints faced in livestock production in each of the farming systems identified.

2. Commencing in project year two, an in-depth frequent interview survey of the Gambian livestock and crop enterprises were to be conducted, in order to obtain a thorough understanding of the main farming systems in Gambia which incorporate such enterprises. These surveys were to provide data on inputs and outputs for each crop and livestock enterprise, estimates of income derived from and productivity of such enterprises, relationships between these enterprises, detailed information on cash flow, decision-making and management practices, particularly with reference to livestock, and quantitative technical information requested by project technical scientists. These were called the INTENSIVE VILLAGE STUDIES BY MFP. Commencing in project year two, and throughout the project, special surveys were to be conducted in order to evaluate technologies being tried in the other project components. In addition, there were to be complementary or supplemental socio-economic studies to be conducted on issues related to on-going activities under the project.

The planned studies listed were:

a. Range Management and Forage Agronomy. Herdsmen's perception of the value of different plants, grazing practices, utilization of groundnut hay, etc.;

b. Maize Program. Disposition of maize for human food and/or animal feed and provision of shellers and grinders;

c. Cattle and Sheep Fattening Program. Economic feasibility of the program and compatiblity with existing farming systems and the market situation;

d. Farm Cart Program. Examination and testing of the potential of farm carts; determination of the degree to which the farming system could be improved as a result of using the carts;

e. Marketing Study. Effect of intensified production systems on livestock marketing;

f. Livestock Owners Association (LOA) Study. Determination of whether LOA's are the appropriate vehicle through which interventions should be channeled in terms of achieving equitable access to benefits; how dynamics of relationships within LOA's change over time; effect of the LOA organizational structure on structures at the village level.

g. Other Studies. Effect of land tenure systems on increased land usage issues relating to livestock routes (damage)

3. The training of counterparts in conducting and analyzing field surveys with opportunities provided for advanced degree training in overseas institutions. Short courses would be given for enumerators on interviewing techniques, questionnaire administration, field measuring techniques and other analyticial methods.

The Early Mid-Term Evaluation summarized the accomplishments in the first two years. These were many including; the training and fielding of twenty-three enumerators, one senior and one junior supervisor; the writing and administration of the baseline survey and the intensive village studies; and lastly, farm management studies of the maize technology package. Some weaknesses or difficulties were noted which then led to a series of recommendations. These recommendations were as follows:

a. Extend the Project Assistance Completion Date of the project (PACD) from three to five years.

b. The extended planning sessions and shorter meetings, as stipulated in the Project Agreement, should be convened on a regular basis. The evaluation team thought that this would providefor a better coordination of donor activities involved in crop livestock technology development, a feedback mechanism for research and technological findings, and a multidisciplinary approach to technology development. These sessions according to the recommendations were to be chaired by a sufficiently high ranking MANR official, with the SEU serving as the Secretariat. Further, these sessions were to serve the purposes of identifying research needs in livestock/agricutlure and of attaching priorities to these needs.

c. The conduct of the proposed herding study should be postponed until such time when the SEU has the manpower to carry out a more appropriately designed study.

d. The Intensive Village Studies could and should be terminated after the second round of data collection. In their place, less frequent but more focused and immediately useable socio-economic and farm level studies should be undertaken. The selection of these studies was to be based on the prioritized information needs and issues identified in the extended planning sessions.

e. Micro-computer facilities and software should be purchased as soon as possible (i.e., 1984) in order to institutionalize Gambian capability for computer processing of agricultural data. Short term technical assistance would be required to identify computer needs vis-a-vis the nature of SEU's activities and to set up the facilities in country. Colorado State University (CSU) should be prepared to provide technical backstop support to the field, as needed and on short notice.

f. CSU should give top priority to the data processing needs of the SEU in order to insure a quick turn-around. This particularly applies to the processing of the Baseline Survey, Intensive Village Studies and the Farm Management Studies of the Maize Technology Package. While it was proposed that subsequent studies and surveys would be processed in country, it was understood that technical backstop support would be provided by CSU as indicated earlier.

g. The following additional training was recommended: (1) short term training in computer programming; (2) long term training in computer science, with a minor in agricultural economics, and (3) longer term training in agriculture with a minor in marketing.

h. The agricultural economist position in the SEU should be maintained throughout the life of the project. Short term technical assistance be obtained to assist the SEU analyze the results of the Intensive Village Studies and of all Farm Management Studies of the Maize Technology Package.

i. A rural sociologist or anthropologist is critical to the project. Implicitly, this position was to be maintained for the life of the project.

j. A marketing specialist for corn and livestock should be recruited immediately to conduct the necessary marketing studies.

k. Arrangements should be made to formalize and finalize the transfer of the SEU to the PPMU. These arrangements should include an agreement among the MOA, FAO, OAR/Banjul and the MFP on matters related to technical supervision and administrative responsibilities. Equally important, an agreement must be reached on the role of the SEU vis-a-vis the PPMU and MFP. The transfer should be done as soon as possible after the PPMU officially starts operations.

l. A minimum of three local social scientists or PCVs should be deployed to the SEU as soon as possible to provide the linkage at the field level between the SEU and the other three MFP technicians.

m. The SEU should develop a working relationship with the Women's Bureau, which is responsible for coordinating development activities related to women in The Gambia. This proposed activity involves the provision by the SEU to the Women's Bureau of research information related to women, in order to assist the Bureau to plan effective strategies for women's development programs. In addition, the SEU should involve the Women's Bureau in developing questionnaires that pertain to women. This will ensure that where appropriate, the Bureau's information needs are obtained by the SEU.

Shifts in Component 5: - As a result of discussions between the Early Mid-Term Evaluation Team, OAR/Banjul and MFF/CSU/CID a Project Authorization Amendment Package wasadopted on August 31, 1983. The ammendment reaffirmed the role of SEU and stated that "the Planning, Programming, and Monitoring Unit (PPMU) which serves the Ministries of Agriculture, and Water Resources and Environment, is a natural recipient and user of such information. It has been intended from the beginning that the project's SEU, as an operating entity, be folded into the PPMU, and this will occur gradually during the life of the project".

With respect to the design, coding, processing and analysis of the farm systems data two aspects were considered: the provision of asenior short-term technical assistance to do the former, and to shift from data processing at CSU to The Gambia through the use of a microcomputer system.

In addition, a two-year long, long-term technical assistance marketing analyst was added to SEU to lead studies on maize and livestock marketing and other studies to be determined later.

The lack of project integration was to be corrected by introducing integrated village trials which were to bring the different packages together. These were projected for the third year but in fact weren't carried out until the fourth. Thus, the observation that if they were successful they would be expanded to larger numbers of villages did not occur. The ammendment notes that the success of this effort should be a major determinant of whether a follow-on project ought to be initiated and, if so, its content.

Certain elements of the original project were eliminated. The elimination of component D. Improved Rural Technology also reduced one ofthe parts of SEU's monitoring, testing and evaluation functions.

The Integrated Work Plan For The Final Two Years of the Mixed Farming Project: - In April 1984 responding to the Early Mid-Term Evaluation, and the Project Amendment, MFF held extensive internal discussions and consultations with OAR/Banjul in an effort to coalesce and direct the overall effort. According to the special administrative report "social science activities are grouped under Agricultural Development Services(ADSS) [to] emphasize that their primary role is to collaboratively support the technology development, testing and extension role. The ADSS terminology is explicitly substituted for the former "Socio-Economic Unit", a term which emphasized a relatively separated work agenda. By far the bulk of the ADSS work for the remainder of the project centers on field evaluation of technology packages, developing marketing strategies for the outputs of MFF technical thrusts, collaboration in the design of on-farm trials and characterizing and analyzing the various mixed farming systems in The Gambia. All of these activities must be done with biological and social scientists interacting closely together."

Two areas, both in the M.I.D., Piniai and Boiram, were chosen as the sites in which to conduct this integrated test. Much of the earlier data gathering functions of the SEU ceased as enumerators were stationed in these areas with primary attention devoted to Boiram and the neighboring village of Njoben, and Piniai and its neighboring village of Choya.

The Revised Set of Scheduled Outputs: - In support of the over-all goal of increasing rural well-being MFF listed eleven outputs that could be expected from ADSS (formerly SEU):

1. Baseline study of rural sector and intensive study of farm management practices. Project will provide full initial analysis and make raw data available to MOA for subsequent studies.

2. Market reporting system providing a routine flow of data on rural market conditions to market analysts in GOTG and to a market news service under Extension.

3. Selected policy studies to be conducted jointly with PPMU.

4. Two major market evaluations, one for maize and one for livestock.

5. Micro computer equipment and Gambian staff trained in its use incorporated in GOTG with planning and policy analysis functions.

6. Economic and social studies: (a) evaluation of maize technology package; (b) evaluation of cultivator technology; (c) analysis of management capacity of LOA's; and (d) selected market policy analyses.

7. Active social sciences participation in village reconnaisance studies and in entire integrated village program.

8. Aerial photos, resource inventories and a herbarium collection. (Placing this item here reflects the desire to integrate activities more and to end separation of biological and social scientists. However members of SEU were not particularly involved in this exercise.)

9. Trained individuals on Gambian establishment (sic).

10. Short course on agricultural marketing for Gambians with marketing responsibilties.

11. Short term technical assistance on women in development to explore ways in which current project activities can increase their impact on rural women.

GENERAL FINDINGS

There has been a tension throughout the life of the MFF project between the data gathering functions (Function #1) of the SEU and the implementation side. Tension and conflict is not inherently negative but rather it's the outcome that counts. If conflict leads to better, more

relevant research on the one hand, and more effective implementation on the other, than one would conclude that the tension and conflict had been positive. The Early Mid-Term Evaluation focused part of its concern upon the slow turn-around time for the data, and the Integrated Work Program for the last two years went so far as to rename the SEU ADSS, to try to emphasize more involvement in the implementation side of the project.

The original project paper required large amounts of data collection which, except with extraordinary individuals who perhaps don't exist, precluded involvement in the identification of farmer and herder constraints and propose implementation ideas. It appears that while the rural sociologist and agricultural economist were setting up the baseline survey and oriented themselves to data collection, the rest of the team were exploring constraints to production of maize and livestock. Yet, the PP suggested that the baseline survey be the one utilized to identify constraints, both social and economic, in current agricultural and livestock practices.

One perception is that the original SEU members were not particularly open to the implementation side. On the other hand, the Project Paper called for two and one-half percent sample of all compounds in The Gambia to describe and analyze farming systems in The Gambia that incorporated livestock. Efforts by the Project Director to change that requirement were not accepted by the GOTG. In addition, it is clear that the Chief of Party viewed the MFP in implementation terms and wanted to develop and deliver as rapidly as possible, once key constraints were found, packages that would improve rural well-being. He viewed MFP as a problem solving project which kept direction and course for five years. They did not try to take on the world, in his view, but rather tried to make specific contributions where they could. The tension within the MFP was worsened by the difficulties in data processing and analysis. As of this evaluation in March 1986 the descript.- and analysis of The Gambian Farming Systems from the first two years of work has not been completed. (This will be discussed below in greater detail.) It has been very difficult to find much evidence for a substantial SEU input into the implementation dimensions of the project during the first three years. One is forced to conclude that the purposes for the formation of the SEU 1. to bridge the gap between the componen s and disciplines represented in the project and to increase the efficiency of the developmental and implementation foci of the project were not achieved. However, this was probably an overly idealistic goal under the best of circumstances and an impossible one under the conditions described above.

Following the Early Mid-Term Evaluation definite changes were begun which resulted in MFP being highly responsive to some of the recommendations. The addition of an in-country micro computer facility and a marketing specialist, the gradual return of Gambian SEU members who had been sent to the United States for training and a new agricultural economist and sociologist changed in a major way prior directions. The dropping of the Intensive Village Studies then freed up staff time so that there could be much greater collaboration between SEU and the technicians, and also the long proposed involvement with FENU.

The current agricultural economist elected, for good reasons, not to be involved in the analysis of the BSL and Intensive Village Studies. He arrived on June 15, 1984 although he had served as a consultant from February 19-April 27, 1984 to assist with the work plan, the structuring of economic analysis, to develop data collection procedures to analyze the MFP integrated program, and to assist in the outline for SEU's major report. The marketing specialist arrived for a two year stay on January 16, 1984. The first sociologist completed his forty six month assignment on November 15, 1984 and his replacement arrived on January 5, 1985. The latter also did not involve himself in the first three years of data analysis although he did complete a survey of the Livestock Owners Association based upon work done earlier by the first sociologist. One of the difficulties of the first sociologist was that he had no Gambian counterpart Mr. Momodou Jammeh left for training shortly after his arrival and did not return until September of 1984. The marketing specialists' counterpart Fasainy Dumbuya left for a B.S. degree in Agricultural Economics with an emphasis upon marketing in January 1984 and returned shortly before the T.A.'s departure. However, Kalamanlie Juwara served as counterpart for he marketing specialist during Mr. Dumbuya's absence.

A major shift took place in MFP with the completion of data collection for the first three years and the shift to an integrated program in the villages of Boiram/Njoben and Piniai/Choya. While some enumerators were involved in data collection in these villages, others served with the marketing specialist in the collection of price data for selected markets and commodities. The fundamental purpose of this exercise was to see how the different interventions would interact together in conducive village environments. Perhaps the most important component for SEU in this integrated applied/research setting was to assess the project's impact upon economic well-being. This dimension of SEU's work has been difficult to identify precisely. Much of it will be contained in the farm management surveys conducted on sample households in these four villages. These were not available since data collection was just being finished. Analysis will be tricky since no compound of the sample being surveyed adopted all aspects of the maize, deferred pasture, and crop residue package. One anticipates in any event that the results will not be definitive since many of the variations in utilization cannot be accounted for by the nature of the studies. Rather they will be indicative and can be used in considering equity issues, consequences for women as well as the more direct and quantitative measures for increases in agricultural productivity and allocation of labor.

Another dimension added to the MFP was adding Melanie Marlett to conduct women's programs following the completion of her Peace Corps work with MFP. The results of her and Marie Sambou's work can be found in Food Production/Consumption Linkages: Final Report, July 1985. It is clear that the processing of maize (i.e. shelling, dehulling and pounding) has added to women's work in comparison to the processing of millet. This problem will be raised in recommendations for future activities. It is also clear, that MFP was responsive to the implications of increased maize consumption (as they were to marketing) and conducted food preparation

demonstrations. These were then partially monitored by the rural sociologist and Ms. Marlett. This is a good example of an effort to follow through on the real consequences and uses of extension activities.

The marketing specialist involved himself in the addressing grain storage losses and assisted in planning, designing and promoting a relatively rat-proof granary. In addition, the design permits a greater circulation of air which permits a less labor intensive way of drying maize. Demonstration granaries were constructed in several villages. In the longer term, these will probably have to be located in compounds, as are the other granaries, to be fully utilized.

Because of the importance and relationship of SEU and PPMU this subject will be treated separately in the next section. It is clear that much of the work by both the rural sociologist and agricultural economist in the last two years has been guided by the presumption that one of their major tasks was to provide technical assistance to PPMU and assist that organization in its capacity to collect and analyze socio-economic data.

THE PLANNING, PROGRAMMING AND MONITORING UNIT FOR THE AGRICULTURAL SECTOR IN THE MINISTRY OF AGRICULTURE (PPMU)

PPMU was created to serve the Ministry of Agriculture (MOA), the Ministry of Water Resources and Environment (MWRE) and the Ministry of Economic Planning and Industrial Development (MEPID). The purpose throughout is to serve the agricultural sector, no matter what ministry is involved. Thirteen specific functions are listed for PPMU of which the following were directly relevant to MFP:

1. To monitor progress and evaluate effects of ongoing development activities, and propose adjustments to programs and projects in accordance with experiences gained and changing conditions over time.

2. To conduct micro-economic research and prepare information so collected on farm economics and management, and rural sociology for systematically incorporating these into the policy analysis, planning and programming processes.

3. To carry out micro-economic investigation and statistical surveys on a continuing basis in order to provide the data necessary for policy considerations, planning and programming of the agricultural sector.

4. To balance manpower requirements with availability as a precondition for program and project implementation.

5. To promote manpower development in an orderly and purposeful manner, and arrange for apropriate training programs to that effect.

These are not the only matter that intersect with MFP but the most important ones.

The paramount purpose of PPMU was to institutionalize a planning system in the Ministry of Agriculture in the form of a staff unit, as opposed to a line unit, serving the agricultural sector as a whole. The funding for PPMU's creation came from UNDP and FAO. It is clear that PPMU has to gain greater respect and confidence of the relevant technical departments and statutory bodies to be more effective. As pointed out in the UNDP Project Document "Sectoral analysis, and programme and project development, to be relevant and effective, must be based on broad technical knowledge and ample field experience so as to understand agronomic and pastoral conditions,[and] socio-economic relations which determine the nature and level of The Gambia's agricultural output, and to appreciate the national agricultural development problems and policy issues."

While the intent of working with PPMU had been in the MFP work plan, it has only been since the accession of directorship by Mr. Sam Kinteh in July of 1984 that it fact has been institutionalized. As already noted, the Socio-Economic Unit of the Mixed Farming Project was to be folded into PPMU. In practice what this has meant is:

1. The Gambian counterparts for MFP are part of the staff of PPMU including Baboucar Gai who is now Assistant Director; Kalamanlie Juwara (who is no longer with PPMU), Fasseiny Dumbuya, and Momodou Jammeh.

2. Eighteen of the enumerators who worked for MFP have now been taken on as enumerators by PPMU.

3. The annual work plan for the Farm Economics and Rural Sociology Section of PPMU and the relevant portions of MFP-SEU were developed to be identical.

4. The rural sociologist began assisting in the monitoring of Jahaly-Pacharr irrigated rice project begun by PPMU. He worked with his counterpart in the writing, pretesting, design, training, and analysis of four short-questionnaires. Two of these have now appeared as PPMU reports.

5. The agricultural economist has been working to develop a new agricultural information gathering system, both a general one for national statistical purposes, and a more specific one to gather data from each division on a rotational basis to ensure more accurate and up to date information for the farm level. After all the difficulties with the FAO FMDCAS system the agricultural economist has developed a new instrument called The Gambian Agricultural Data System (GADS).

6. The marketing specialist with his counterpart in PPMU and the Extension Aids Unit set up the marketing news radio program.

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The UNDP/FAO Project begun in 1983 expires in December of 1986. Future support remains unclear at this time. In addition, there is some World Bank technical assistance. The delay in MFP's establishing a close working relationship with PPMU had nothing to do with MFP but reflected the organizing of PPMU, which remains a fragile institution. The plans for PPMU have been somewhat scaled down (see PPMU Paper #12 in comparison to Paper #3) but remain ambitious and complex. However, the objective of providing accurate, more up-to-date information on agriculture in as objective a fashion as possible is essential. MFP has made a major contribution to their work but this is in process. Much of what MFP has done in collaboration with PPMU (GADS, for example) has yet to be implemented.

The over-all goal of Component #5 of achieving a socio-economic unit to plan and evaluate projects rests upon the work still in process with PPMU. The SEU has certainly taken seriously their mandate to assist PPMU in their program even if that involved work not directly connected with the MFP technical packages. This point will be taken up again in the recommendations.

GENERAL EVALUATION OF THE FOUR FUNCTIONS ENVISIONED IN THE PROJECT PAPER

1. Provision of qualitative and quantitative information that describes and analyzes livestock and other land use systems in The Gambia.

   There has been far more data gathering and processing than analysis has permitted. In part, this was due to the decision to base the Intensive Village Studies upon the FAO program FMDCAS which turned out to be a flawed and unusable program. Thus, much of the detailed farm management data collected for two years will not be analyzed. Some of them will be included in the Gambia Mixed Farming Systems Report. The first year Baseline Survey was completed but the turnaround time has been inappropriately delayed. The overall quality of the report is good and ultimately will be useful to those seeking a general overview of Gambian agricultural and livestock systems.

   Two other major reports, The Livestock Report and The Maize Report will combine efforts from both the SEU and the technical/implementation staff. These should be important contributions detailing the notable achievements as well as experiments that MFP has tried. However, it is unclear that the quality of the reports can be maintained within current pressures of writing. The livestock report exists in partial draft with some data still not entered and therefore with analysis yet to go. The maize report has not been seen. This will be the subject for a brief recommendation below.

   In addition to the three years of major data collection has been the detailed farm management studies in the villages of Boiram/Njoben and Finiai/Chova. These should be of high quality but there is concern about their completion given all the other reports that also have to be done.

The marketing specialists' work will be primarily be included in marketing sections of both the maize and livestock reports in addition to the publication of charts and graphs of prices. It appears that further inputs will be needed from him in the revised version of the current drafts.

A survey was done of the Livestock Owners Association and its relative dormant status aside from MFP activities. This has been the subject of a brief report and will be included in the Livestock Report.

A paper will be prepared on land tenure issues involved in increasing livestock and agriculture production.

In general, not enough time was left for the analysis and writing in relation to the data collection. This is a common problem in projects. Analysis proceeds in several stages and it usually takes longer than one thinks to make sense out of data.

2. Test the suitability of technological packages developed by the Project and the potential of institutions serving producers to determine the incentives and support necessary for increased production.

   Our finding here is that the technical/implementation staff on the one hand, and the data collection demands of the SEU on the other, did not permit as much collaboration as would have been desired. A major exception to this has been the study of the cultivator, a draft one done for the first year and a revised one for the second. This evaluation will be included in the maize report which has not been seen. The use of fertilizer and the degree to which farmers followed technical instructions for the MFP maize package will be included in the maize report. There has been monitoring of the crop residue and deferred pasture aspects of the technological package. Due to difficulties in sampling this has been more of an observational and interview type of data gathering exercise.

3. Monitor changes over time brought about by the Project and evaluate results. It will ascertain whether or not strategies are proceeding as planned and assess the impact of the Project.

   One way this could have been done is if there had been the appropriate baseline data and if the BSL had been redone. Baseline data drawn from households that had not adopted the MFP packages could have been compared to those from households in Boiram/Njoben and Piniai/Choya where many of elements of the full MFP package had been introduced and where there had been a relatively long exposure to MFP (particularly in Boiram). Even if this had been done the results would not be definitive.

   Much of the actual monitoring was carried out by the technical staff (for example in the performance of agricultural demonstrators or pasture assistants). It was not done by the SEU.

It would appear that the technical emphasis was upon performance and not upon monitoring. The problem is the same as noted above in function 2. In principle, it would have been better to have done more monitoring of MFP to know the degree to which the changes that have been demonstrated and used because of the project will be sustained without continued project intervention.

One model for monitoring has been adopted by the rural sociologist in his collaborative work with PFMU at Jahaly-Pacharr. There he has opted for relatively short surveys on specific important issues to focus upon the actual outcomes of the project. This will help project management to understand the range of changes induced and to shift policies if need be. These monitoring & evaluation studies are appearing as a series of PFMU papers. In addition, these can be done with a short turnaround time and with the use of a desk calculator. They are an excellent alternative to overly intensive data collection efforts with slow turnaround time.

Another model for monitoring for agriculture at a national level (the national sample survey) has been redesigned by the agricultural economist.

This will, if implemented, greatly increase the available information about Gambian agriculture on a yearly basis. In addition, he has designed the Gambian Agricultural Data System which is meant to keep productive system information up to date.

Both of these last two activities can be seen as the important continued monitoring of Gambian agriculture which in turn will reflect the longer-term impacts of MFP. It is well to remember that farmers in both the villages of Boiram and Njoben have plots in Jahaly-Pacharr so that maize was introduced into a farming system that included irrigated rice. What will be signicant to know from current farm management studies is the degree to which rice and maize are commercialized in this particular combination.

4. Train Ministry personnel in socio-economic orientation and train counterparts to conduct and analyze field surveys, arrange short courses for enumeators in interviewing and analytical methods.

This was effectively carried out. The training of enumerators, their quality and performance as noted by the Early Mid-Term Evaluation, has continued. Some of the enumerators have now been trained in computer data entry operations. Eighteen of the enumerators have been hired by PFMU to provide a core of fieldworkers for future work.

As noted previously, a rural sociologist and an agricultural economist received their B.S's, and Mr. Baboucar Gai received further training in data processing and analysis. The further details of training are detailed in Component 6.

RECOMMENDATIONS

1. THE MAIZE PROGRAM

It is clear that the most successful part, or the most widespread consequence of the project has been an increase in the numbers of Gambians who produce maize. It appears that there has been an increase in: the yield per hectare for many farmers even though this is not as well documented as one might like, the consumption of maize and the marketing of maize. In order to predict the continued success of maize in The Gambia and to make recommendations for its continuation one needs to understand the context as to why MFP's maize program was so successful. This is not a full explanation but rather a listing of some of the elements that led to its success:

a. The recent years of drought and the increased length of the hungry season due to poor harvests and late rains. Maize meets very well the need for an earlier harvested grain.

b. A reduced labor requirement for maize in comparison to millet, groundnuts and rice.

c. A relatively high price for maize, and a relatively high return to labor.

d. The use of a new, higher yielding maize seed, in combination with fertilizer.

f. Mixed Farming played a critical role in training extension workers as well as being extension agents themselves in demonstrating how to resolve problems in maize production.

ISSUES STEMMING FROM THE MAIZE PROGRAM

One issue is how well will maize do in the absence of both the extension and input supply carried out by Mixed Farming?. The MFP has been a constant and well-known, reliable presence for five years and their absence may have greater negative consequences than is currently anticipated..

A second issue concerns the priority of maize in the cropping system and to what degree it will change. At this point maize takes lower priority than millet or groundnuts. It is unclear whether this is a lag or whether maize will remain of lower priority in the cropping patterns. This question should be monitored.

A third issue only begun to be tackled by MFP concerns women's food processing involved in the shift to increased maize production. It is possible that the additional labor is not that great but this depends on the amount of production which in turn depends on the quantity and priority of maize within Gambian farming systems.

A fourth issue concerns who has the resources to engage in maize production. MFP deliberately chose to work with more rather than less successful farmers. They chose individuals who they thought would be leaders in their communities and who would serve a demonstration effect. Equity issues, and the importance of draft animals, were not fully examined. It remains to be seen if this projected spread effect will indeed take place or if relatively wealthier Gambian male farmers will be the only ones to continue maize production.

Recommendations:

a. Further work on maize should emphasize increasing yield rather than increasing area.

b. Increased work needs to be done on the shelling and processing of maize. There appears to be variation as to who does the shelling, sometimes men and women, other times just the women. The shelling, pounding and grinding operation is viewed as women's work.

c. If current bimodal patterns of rain continue this may pose a danger to the 90 day variety of maize. Improvements in shorter variety sorghums and millets are therefore of great importance.

d, Seed will become a problem as yields diminish. Replacement of seeds will need to be organized and sustained.

e. Currently there are few pests to maize. It is unlikely that this situation will continue. Alternative seed varieties, or plans for what to do are appropriate to sustain current gains.

In sum, there needs to be a longer run plan for training and for technical assistance to monitor and change the maize package as conditions change. In enumerating some of the reasons for the success of the maize program we have also identified some of its possible future difficulties. While the maize program was MFP's greatest success, it has real limits and may not, for the reasons listed above, be self-sustaining.

The same principles can be applied to other MFP interventions which are less widespread now. The issue is the degree to which they have taken root and will be carried out without MFP assistance and prodding. The preliminary conclusion would be that many of these efforts including the cultivator, corn crib, deferred pasture, storing of crop residues, food processing mills for maize but could be used for other crops, maize shellers, et al. will not be self-sustaining without additional outside support. This is not because these programs are not worthwhile or self-sustaining, but rather because

some of these technologies were introduced late in the project's life (e.g. cultivator, corn cribs, food processing mills, et al.) and partly because they tread a fine line between the available resources to many farmers, and how they allocate them. In addition, the question of local institutions and their viability combined with the efficacy of national rural efforts may well place these initiatives in jeopardy.

2. PPMU

As noted above, the SEU unit is to fold into PPMU by the end of the project. This has already taken place in the sense that SEU counterparts are working primarily at PPMU. The scope of work for PPMU is broad and they are liable to change their work because of ministry needs. In addition, the PPMU facility has not been adequately upgraded, and staff, while committed, are over-extended and could use increased training. It is simultaneously clear that given current financial constraints the GOTG will not give high priority to PPMU despite the importance of its work. The issue is the degree to which that work is essential for furthering The Gambia's agricultural development and the provision of accurate information. In our view it is. We recommend that there should be continued support of the PPMU and its work. The alternative is to recreate the same institution elsewhere. Specifically we recommend that PPMU be assisted with three technical assistants for three years for the most effective continuation of MFP's efforts:

a. An Agricultural economist to assist in implementing the new GADS system and national agricultural data collection. In addition, this person should provide the needed statistical skills for the improvement of data collection and analysis and the continued training of PPMU personnel in statistics. In addition, market data collection and marketing news should be continued.

b. A rural sociologist or anthropologist to provide technical assistance in the determination of sociological consequences of development interventions and whether or not they are meeting their stated objectives. The monitoring and evaluative capacity of PPMU is essential. The current sociologist Mr. Jammeh only has a B.S. and will be called upon to do too many things. It is unfortunately the case that he is the only practicing rural sociologist in The Gambia.

c. A data processing/computer technical assistant to assist in the most effective utilization and maintenance of PPMU's computer facility. In our judgment PPMU is not ready to receive the MFP's computers. We suggest a delay in moving them to PPMU where the electricity, facitilties and personnel until such time as they are. In the interim, GARD could have responsibilty for their operation and maintenance while providing access to PPMU.

d. In addition to technical assistance there needs to be an upgrading of the FPMU facility to facilitate professional work. This includes: Provision of some office supplies and logistical support to ensure that the enumerators trained by FPMU will be effectively utilized in the field, and to ensure that office personnel can carry out their functions.

FPMU itself as an institution needs to take a more clear cut sense of its priorities and scale-down its ambitious mandate. It cannot under its current staffing and financing carry out all of its assigned work. We recommend that FPMU as part of this larger task also develop a plan for the effective utilization of its personnel to ensure that vital activities do not lapse during the absence of key staff for further training.

We also suggest that monitoring need not be always carried out by enumerators. We would like to see a more day to day involvement in the field by FPMU so that they do not lose touch with rural Gambia and that they themselves carry out specific data gathering and analysis.

3. COMPLETION OF THE SOCIO-ECONOMIC STUDIES

We are concerned about the completion and quality of the final reports. Still in process are: (a) The Gambia Mixed Farming Systems Report (based upon years 1 and 2 data), (b) The Maize Report, and (c) The Livestock Report. The latter two combine the efforts of the SEU and technical/implementation components. We believe that the efforts of a scientific editor to edit the text, and clarify the tables would greatly enhance their value.

4. FOOD PROCESSING AND LABOR CONSTRAINTS

While MFP noted and did some work on food processing, in particular maize, further activities need to be sustained. These include a technological assessment of the millers and grinders distributed by MFP , their degree of acceptance and whether any modifications can or should be made. In particular, it would be unfortunate if greater production of maize led to increased work for women. In addition, attention needs to be addressed to the labor constraints involved in the planting of forage legumes and grasses and detailing when would be the best time to carry out these activities during the rainy season heavy schedule. This recommendation supports those in the range/livestock one but suggests that timing within the overall agricultural cycle will be critical to success.

5. UNIT OF ANALYSIS FOR FUTURE SOCIO-ECONOMIC STUDIES

MFP, like most other studies, assumed the existence of the compound as the "production-consumption" unit. They found, on the basis of their baseline survey, that there was joint

management of both production and consumption activities by the family. There needs to be a serious reconsideration of the appropriate units for analysis of rural productive activities. While appearing to be an abstract issue the Gambian rural arena is rapidly changing and the older mechanical model of compound structure is giving way to new and varied forms. This will have specific and direct outcomes for development activities.

6. Generalizations based upon ethnicity are suspect. While there are some differences , for example in average household size, or in inheritance patterns which lead to different land tenure systems, variation is more likely to be due to cropping patterns, participation in irrigated rice schemes, access to swamp rice land, proximity to urban areas, et al. Such a reconsideration would assist AID to improve knowledge of rural production systems and their further development.

7. The MFF five year effort provides an excellent opportunity to see what of their work is sustained after they leave. This evaluation cannot definitively assess the sustainability of their work. To assess empirically the benefits to the rural populations of The Gambia requires a short term follow up evaluation, perhaps on the order of one month. What are now hypothesis about benefits and impacts need future field testing to assess both the effectiveness of MFF and of AID's country development strategy. We suggest that this be done three to five years after project termination but at the end of the rainy season to be able to assess project impacts, equity issues, contribution of maize as a food and cash crop and to determine the use of different MFF technological components.

ANNEX D

COMPONENT 6
AGRICULTURAL SKILLS TRAINING AND COMMUNICATIONS

A. Objectives

As described in the original project paper, the purposes of this component of the project were:

1. To make good use of Gambians who have already received training in animal health, animal husbandry, and related subjects.

2. To provide better pre-service and expanded in-service training opportunities for Agricultural and Livestock Officers, Assistants and Inspectors.

3. To train a core of Livestock Officers to take over the management of the basic components of the project.

4. To restructure the syllabus of Agricultural and Livestock Assistant and Livestock Inspector training.

5. To provide a multidisciplinary focus in improved pre-service instruction.

6. To increase training oportunities for ox farmers, livestock owners, and contract herders.

7. To foster increased coordination in establishment of training objectives and policies among the Departments of the Ministry.

8. To assure a close association between the communications support services of the Extension Aids Unit and the training activities of the Departments.

Specifically, the project paper called for the following outputs:

1. Ten trained Gambians who will reinforce Ministry staff and support project objectives.

2. Twenty trained Gambian manual laborers or machine operators who will help provide sound infrastructure for the project.

3. Improved multi-disciplinary training syallabi; better trained staff; establishment of a field training center and demonstration activities for farmers.

4. Collaboration with Gambian livestock field agents and enumerators.

5. Initiation and exposure to basic principles of training strategies and communications support techniques for 50 Gambians during each workshop.

6. Improved pre-service and in-service instruction through the widespread use of audio-visual support materials.

The ten Gambians trained under output number one above were scheduled for training as shown in table D-e-1.

The twenty Gambians trained under output number two above were to receive the following training:

Persons to be Trained

a. One Honda mechanic at the Yundum Ministry motor pool.

b. Two laboratory assistants at Civil Service Grade 1 for the feeds laboratory at Abuko.

c. Twelve fence builders.

d. 1 tractor driver/operator for post hole digger operation.

e. Three fence menders

f. One operator for maize sheller at Yundum.

The six long-term U.S. technicians were to provide the training called for in output number three above, as follows:

Forage Agronomist:

Teach courses at Abuko for local staff.
Supervise extension work at YBK center.

TABLE D-6-1

PARTICIPANT TRAINING SCHEDULE

Entry Level	Course Level	Speciality	Student Number	Training Duration	Training Location	Training Start	Prospective Assignment
Diploma	B.S. or M.S.	Forage Agronomy	1	2 years plus observational tour in Australia	U.S.	1980	Replace U.S. Forage Agronomist/Abuko
Diploma	B.S.	Maize Agronomy	1	2 years	U.S.	1980	Replace U.S. Maize Agronomist/Yundum
Diploma	B.S.	Extension Education	1	2 years	U.S.	1979	Departmental Training and Information Unit/ Abuko
B.S.	M.S.	Agricultural Economics	2	2 years	U.S.	1980 & 1982	PPMU/Ministry
B.S.	M.S.	Rural Sociology	1	2 years plus observational tour in Holland	U.S.	1980	PPMU/Ministry
Diploma	B.A.	Communi-cations	1	1 year	U.S.	1979	Extension Aids Unit
B.A. or B.S.	M.A.	Communica-tions Evalua-tion	1	2 years	U.S.	1980	Extension Aids Unit
Certifi-cate	Associate Degree	Media Techno-logy And Film Production	1	1 year	Africa	1980	Extension Aids Unit
Certifi-cate	Diploma	Graphics	1	1 year	Africa	1980	Extension Aids Unit

Total 10 Participant Trainees

15 Participant/years from 1979 to 1984.

Maize Agronomist:

Teach at Yundum for Agricultural Assistants.
Hold seminars at YBK center for all staff.
Supervise regional testing at Mixed Farming Centers.

Range Ecologist:

Teach local staff at Abuko, Yundum and YBK
Train the Gambian range management specialist in the following fields:

a. Plant identification.
b. Applied grazing and land management principles.
c. Herbage yield data collection.
d. Photo identification.
e. Conduct of field trials in grazing and forage quality evaluation.

Agriculture/Livestock Economist:

A. Train unit enumerators for field data collection and analysis.
B. Teach local staff regarding:

   a. Use of survey methods.
   b. Testing of technciogical packages.

Rural Sociologist:

A. Train unit enumerators.
B. Teach local staff:

   a. Survey and interviews techniques.
   b. Testing of technological packages.

Peace Corps Volunteers were to have provided the training shown in Output number four above. Thirteen volunteers were proposed to accomplish the following:

Field	Suggested Posting	Service Dates	Training Role
1. Forage Agronomy	An up-country Mixed Farming Center	1980-84	Train livestock and agricultural agents to perform studies on groundnut feed supplements for livestock.
2. Forage Agronomy	A second Mixed Farming Center	1980-84	Train livestock and agricultural extension agents to perform on-farm testing of legumes in fallow rotations.
3. Forage Agronomy	Village-level	1980-84	Collaborate with agricultural and livestock extension agents and train farmers to help evaluate trials of traditional and improved vegetative covers for animal feed.
4. Agriculture	YBK Center and area	1980-82	Train YBK staff in the setting up demonstrations of farm cart use for Livestock Owners Associations.
5. Social science research	YBK Center and area	1980-82	Train YBK staff and enumerators recruited by the socio-economic unit in field research concerning attitude surveys and effectiveness testing.
6. Animal Nutrition	YBK Center and area	1980-84	Train YBK staff and livestock extension workers to introduce livestock fattening schemes.
7. Social science research	YBK Center and area	1980-84	Train YBK staff, Department extension agents, and enumerators in field research concerning attitude survey and effectiveness testing.
8. Animal nutrition	Yundum/Abuko	1979-83	Train Livestock Assistants and Inspectors in field sample collection and laboratory forage and feed evaluations.
9. Animal nutrition	YBK Center and area	1979-83	Train YBK staff and Livestock extension agents in field sample collection and laboratory forage and feed evaluations.
10. Range ecology	YBK/Sapu area	1981-85	Train Gambian range management specialists in plant identification and carrying out research trials on local ecology.
11. Social science research	YBK/Sapu area	1981-85	Train Gambian range management specialists and enumerators in field research on farmer attitude toward range management systems.

12. Graphics	EAU/Yaounde	1980-84	Train counterparts and collaborate with Department liaison representatives in the production of graphic materials for training and extension activities.
13. Communications evaluation	EAU/Yaounde	1979-83	Train Department liaison representatives; agricultural and livestock extension agents; and mobile cinema van driver/operators in simple methods of feedback data collection and train EAU counterparts in data analysis.

Workshops, as listed in output number five above, were to be in training of trainers and communications. Their largest audience was to be the staff of Extension Aids Unit, the Film Unit, the Rural And Farm Broadcasting Unit of Radio Gambia; and the Liaison representatives from the Ministry Departments. The training element from these annual workshops would consist of the following: identification of specific communications problems; consulting relevant documentation; elaborating elements for a national communications policy; enlisting the support of central and field Ministry personnel to help improve the communications network.

In late 1981, there was to be one workshop on training, organized by the Agricultural Sector Implementation Project in Washington, D.C. The participant trainee in extension education was to have taken their six-week course in development planning and training and would act as chief Gambian organizer and co-leader of the workshop upon his return from training. The purpose of the workshop was two-fold:

1. To bring Ministry Department heads and directors of training together to analyze their common or specialized training needs, related problems, and suggestions for future training designs.

2. To provide the professional opinion of an outside body concerning the training programs and their effect.

In early 1982, a U.S. cartography specialist was to come to The Gambia to run a three-week training seminar in photo interpretation with the new aerial maps of The Gambia produced under the project. This program was to be designed to include all interested staff in the Ministry and on-going AID-donor projects. The workshop represented the final step in the two year process of making the project mapping activity, which involved highly specialized and refined technology, directly relevant to the Gambian officials by explaining to the widest possible audience the practical applications of the exercise. The instructor was to explain the progressive stages of photo mapping and interpretation. Actual Gambian map samples were to be studied by using pocket stereoscopes. The product of the workshop was to be a training manual for photo interpretation similar to the one utilized by the U.S. Soil Conservation Service.

Output number six above was designed as follows:

Training materials must be procured to support the Abuko/Yundum and YBK Training Centers. Since many of these will be audio-visual aids, the natural coordinating body of such materials is the Extension Aids Unit. The Unit should receive and catalog such materials and then let them out according to priority need. The nature of training materials required will vary with the subject matter, with the level of study, and with the perceived appropriateness of the medium.

Increased mobility to be supplied under Output number seven above was through the purchase of busses, trucks, and motorbikes.

Fifty Honda CD0 motorbikes were to be purchased with a project revolving fund and sold on credit terms to Ministry field staff. In addition two 22-passenger busses, similar in type to the Renault Saviem SG 2 diesel model, were to be purchased to help transport trainees and farmers to YBK, Abuko, and for field work. Furthermore, it was highly recommended that the two seven-ton Bedford TJ-6 trucks be purchased in the project for transportation of pillars, fencing materials, and the like, be fitted with a canopy and with removable benches so that they also can transport passengers occasionally.

The project evaluation of April-May 1983 resulted in amendment to the project paper. Relative to training, the following direction was indicated.

"Complete planned ten long-term participant traineeships by adding one each in range management and agricultural economics. Limit short-term training to that which can be effected in the course of the project activities of technical assistance (TA) staff. All necessary counterparts and extension and enumerator personnel trained in field. Eight participants given short-term training in USA or Nigeria".

Between November 1983 and March 1984 the MFF team developed an integrated workplan for the final two years of the project. This plan was organized to integrate three core activity areas (Maize Production and Utilization, Range Management and Forage Production, and Agricultural Development Support Services). Expected outputs, relative to training, were:

Forty Agricultural Assistants and 150 Agricultural Demonstrators trained in MFF maize production technology.

Twenty-five female Agricultural Demonstrators (Home Economics) trained in maize processing and cookery.

Organizational and/or technical advise to rural groups initiating self-help water development.

Seven field trained, full time Pasture Assistants with an additional five Livestock Inspectors receiving formal classroom instruction only.

Micro computer equipment and Gambian staff trained in its use incorporated in GCTD with planning and policy analysis functions.

Trained individuals on Gambian establishment. (Note: no one connected with the project, nor the evaluators, know what this means).

Short course on agricultural marketing for Gambians with marketing responsibilities.

B. Activities And Accomplishments

1. PRIOR TO MID-TERM EVALUATION:

Long-Term Training:

The PP called for ten long term participants to be trained in the U.S.A. over the life of the project. Instead of one Forage Agronomist the project trained two because of the lack of any Gambians with forage production skills and background. Instead of training two Agricultural Economists, the project trained none. There was more of a need for an Animal Nutrition Specialist and Range Management Specialist. These two fields were completely ignored in the PP but were crucial for project implementation and institutionalization of a forage, range and animal nutrition unit, the two latter in the DAHP and the first in DOA (research at Sapu).

Of the four proposed communications, graphic and media technology training areas, the project chose one, the media technology and film production. This participant was to return in 1984 and was to be attached to the Extension Aids Unit under the DOA. In total the PP identified ten participants and the project sent eight to be trained in the U.S.A. The majority of the participants returned in 1984.

Counterpart Training In-Country:

The U.S. technicians spent considerable time on training of Gambians locally and should be commended for it. The Forage Agronomist trained agricultural officers at all levels in the DOA, DAHP and research in forage production. The Socio-Economic Unit trained 25 enumerators and 4 statisticians in collecting farm management data and general survey techniques. The Range component trained Gambians in fencing techniques, seedbed preparation and seeding procedures and developed a workplan with the counterparts.

Training by Peace Corps Volunteers:

Over the life of the project, thirteen PCVs were supposed to train Gambians. The project only received three PCVs, two agronomists and one veterinarian.

Training and Communication Workshops:

None of the workshops on forage and animal feed, training methodology and evaluation, photo interpretation and use of aerial photography in land use management and planning were held.

Extension Aids Unit Training Materials:

The EAU produced a film of the maize technological package of the MFP. Parts of the film were processed by Color Film Services in London, U.K. There were serious delays in processing caused by a

previous unpaid debt to this firm by the EAU. The same problems exist for the fertilizer demonstration film (FAO), the cotton production film (ADB) and the irrigated rice production film.

2. AT END OF PROJECT:

Long-Term Training:

Table D-6-2 lists long-term degree training funded by MFP outside of The Gambia. The project has exceeded the goals set by the project paper in this training category.

Long-term degree participants, included in Table 2, were sent to the U.S., following mid-term evaluation suggestions, in range management and agricultural economics. In addition one person was sent to study forage agronomy.

Manual laborers were trained at Yundum, YBK and Sapu in seed multiplication, crop production and livestock feeding trials. A core crew of around 10 laborers was maintained at Yundum and seven each at Sapu and YBK. Seasonally these numbers reached as high as 60 laborers. Three tractor drivers were also trained, as well as a Suzuki motorcycle mechanic.

Nine agricultural demonstrators were also trained in the use of the MFP cultivator.

Table D-6-2

Long-term degree training outside of The Gambia funded by MFP

Name	Organization	Field of Study	Duration	Location	Degree
1. Solomon Owens	DOA	Crops Science Agronomy	1/81 to 8/83	Texas Tech. Texas Tech.	B.S. M.S.
2. Alieu Joof	DAHP	Range Science	8/81-8/83	C.S.U.	B.S.
3. M.O.S. Jammeh	DOA	Rural Sociology	9/81-6/84	U. of Missouri	B.S.
4. Amadou M. Jallow	DAHP	Forage Agronomy	1/80-9/83	CalPoly Pomona	B.S.
5. Hassan Sallah	EAU	Technical Journalism	1/83-6/84	C.S.U.	B.S.
6. Musa M'Benga	DOA	Cereals Agronomy	1/81-12/83	Texas Tech.	B.S.
7. Sana M. Jabang	DOA	Extension Education	8/81-8/83	Washington St.	B.S.
8. Momodou M'Boob	DAHP	Animal Nutrition	9/81-8/84	West Texas Univ.	M.S.
9. Fasainy Dumbuya	DAHP	Agric. Economics	1/84-12/85	C.S.U.	B.S.
10. Musa Bojang	DAHP	Agronomy	1/81-12//85	C.S.U.	B.S.
11. Omar N'Jie	DAHP	Range Science	1/84-6/86	C.S.U.	B.S.
12. Lamin Bojang	DAHP	Animal Husbandry	4/81-4/83	Nigeria	Certificate
13. Fatmatta Cole	DAHP	Animal Husbandry	4/81-4/83	Nigeria	Certificate
14. Assan Jaye	DAHP	Animal Husbandry	4/81-4/83	Nigeria	Certificate

Table D-6-3 lists short-term non-degree training funded by MFP outside of The Gambia. This category of training was not included in the project paper but was recognized by MFP as a valuable supplement to long-term degree training and in-country on-the-job training.

Table D-6-3

Short-term non-degree training outside of The Gambia funded by MFP

1.	Solomon Owens (Maize Program Leader, MFP)	- Professional visit to CIMMYT in maize production and research. 3 weeks, 9/85. - "West African Animal Traction Networkshop," Togo. 2 weeks, 4/84.
2.	Bambo Ceesay (Forage Agronomist, MFP)	- Study tour to Texas A&M Exp. Sta. at Beeville and various locations in Florida on seed technology related to tropical forages. 3 weeks, 5/85 - 6/85.
3.	Baboucar Gai	- Data processing and analysis, main frame and micro computers at CSU. Also presented paper at K. State FSR conference. 15 weeks, 1984.
4.	Lamin Jabang (Computer room manager, MFP)	- Intensive short courses in micro-computers, including advanced software application and programming languages, 9 weeks. 1985.
5.	Omar N'Jie and Alieu Joof (Range Scientists, MFP)	- Visit to Kew Gardens in U.K. Training in herbarium management and identification of W. African forage plants.
6.	Lamin Jobe and Kutubo Sanyang	- Three months training in animal nutrition and forage analysis at ILCA in Addis.

Counterpart Training In-Country

The training programs described in this section were either wholly or partly supported by MFP.

1. Marketing Agricultural Commodities for Developing Countries ("The International Marketing School").

   This course has been taught by CSU for 12 years under contract to USDA/OICD as course number TC-140. Bill Spencer and Forrest Walters served as co-directors of this course at CSU. In January 1985 a condensed version (2 weeks) was presented in The Gambia with Spencer and Walters as instructors. Spencer's presence in The Gambia as MFP Marketing Economist permitted incorporating mostly Gambian marketing issues as core materials in the course. Twenty two people attended representing DOA, CSU, GPMB, GCU, PPMU, National Partnership Enterprises, Ministry of Fisheries, Radio Gambia, Crop Protection Services and a few private entrepreneurs involved in export of agricultural produce.

2. The Gambia/West Africa Systems Workshop. This course was presented by the Farming Systems Support Project (FSSP) at MFP's initiation and with MFP support and participation. The course was given March 12-20, 1984, with most of it up-country at Jenoi to get participants away from their desks. Some 30 people attended, mostly from Gambia, but attendees were invited from Senegal, Sierra Leone, Ghana, Ivory Coast and Cameroon.

3. On-Farm Experimentation Workshop. Presented by FSSP, supported partially by MFP, this program was attended by 25 people in May 1985. The course covered methodologies for conducting on-farm experimentation and familiarity with appropriate statistical design for this purpose. The workshop provided an extended forum for interchange between research and extension personnel as well as for discussion between senior officers and agricultural assistants.

4. Specialized Courses In Computer Skills. As MFP developed a functional computer center, it became necessary to provide specialized training in programming skills and on selected software. Paul Jackus, a Peace Corps Volunteer assigned to the projects. Computer operation conducted the following specific courses.

Course	Duration	Number in Attendance
Basic language	28 days	7 people
Lotus 1-2-3	20 days	11 people
Word processing	12 days	6 people
STATPAC	10 days	3 people

3. In-Country Job Related Training. Task and skill specific training became a routine part of MFP activities. Essentially all project personnel were involved, either as trainers or trainees. Subject matter evolved as did the projects workplan. Listed below are several illustrative examples of the job related training programs mounted.

Trainers	Subject and Trainees
Bambo Ceesay Sandra Russo Scotty Deffendol Alieu Joof	Plant identification and sampling methods for herding study enumerators.
John Haydu Manuel Aler-Montalvo Fasainey Dumbuya Baboucarr Gai	Extensive recurring training in all phases of field data collection using sample survey techniques. Given to 25 enumerators used in Baseline and Intensive Village Studies.
Neil Patrick Clyde Eastman M.O.S. Jammeh Paul Jackus	Training in field data collection requirements and procedures of National Sample Survey and the Gambian Agricultural Data System. Given to PPMU enumerators.
M.O.S. Jammeh Clyde Eastman	Monitoring procedures and survey methods for enumerators at the Jahally-Pacharr project.
Bill Spencer Derek Clifford Kal Juwara	Marketing processes, commodity identification, cattle aging by dentition. Given to market news reporters attached to PPMU.
Bill Spencer	Training in construction of village level seed stores. Given selected MFP Gambian staff and PCVs attached to project.
Scotty Deffendol plus personnel from MFP, EAU, DAHP and ITC	Annual, one week workshop for Pasture Assistants.

As an example of this type of in-country job related training, the 1983 workshop for Pasture Assistants drew 23 participants.

The Agenda consisted Of:

1. Tour of the YBK Seed Multiplication and Plant Material Plot.

2. Tour of the MFP activities at Boiram.

3. Tour at Sukuta LOA Range Management Plot.

4. Classroom activities at Abuko.

   a. Basic principles of range management
   b. Socio-Economic Unit MFP
   c. Forage Agronomy Unit MFP
   d. Maize Agronomy Unit MFP
   e. Introduction of crop residues in feeding livestock
   f. Review of LDA participation in MFP
   g. Administrative matters and reposting of Pasture Assistants

The 1984 Pasture Assistant Workshop involved personnel from both DOA and DAHF. Twenty three extension workers participated, including 7 Pasture Assistants, 6 Livestock Assistants, 3 Livestock Inspectors, 6 Agriculture Demonstrators, and one Agricultural Assistant. The theme was "The use of crop residues in the deferred feeding of cattle".

These examples point out the integrated nature of participants and subject matter within the technical in-country training.

The major work with Gambian livestock extension personnel was with the seven Pasture Assistants, the Yundum Livestock Manager and his crew at the DAHF cattle herd. With a background in veterinary aspects, it was necessary to provide them with training in animal production and animal husbandry.

Scotty Deffendol - Annual, one week workshop for field staff
Omar N'Jie, Alieu Joof - conducting the Range Resources Inventory.

Peace Corps Volunteers

Three PCV's were assigned to the project in the first TWO years of the project. Four additional volunteers have assisted in the last two years of the project.

Training of Trainers and Communications

Training stressed cooperation with the Extension Aids Training Unit in which MFP collaborated with FAO, the DOA, and the Soil and Watershed Unit. Emphasis was on training 150 Agricultural Demonstrators and Agricultural Assistants in maize production, harvest and storage of crop residues. The Extension Aids Training Unit was heavily supported the first three years of the project. The fourth year concentrated on bringing farmers and extension personnel together at demonstration sites.

Training Materials

The project purchased five film projectors, a number of items for the Extension Aids Unit for their visual aids production (mimeographs, film, cameras, copy reproduction equipment), two motorcycles, and a Nissan Patrol. Donar support outside of MFP decreased early in the project at the same time that the participant trained under MFP returned to EAU. He then left for a two year assignment in Cameroun. Output has been limited to a promotional film of the MFP program.

C. MAJOR FINDINGS:

Concerning training specialities in Agricultural Economics and in Agricultural Policy, it is noted that Fasainy Dumbuya, now working with PPMU, obtained a B.Sc. in Agricultural Economics (Marketing) at Colorado State University, January 1984 to December 1985. In addition he attended three short courses: 8 weeks at an International Marketing School, CSU; 9 weeks of Grain Storage and Marketing at Kansas State University; and 2 weeks of Keys to Rural Development, Western Illinois University. This scope of training provided intensive as well as broad exposure to concepts of increasing importance to The Gambia.

M.O.S. Jammeh spent three years at the University of Missouri where he received a B.S. in Rural Sociology. He took a short course on Cooperatives and had extension experience in Crawford County during the Summer of 1983. Currently he works for PPMU engaged in the monitoring of Jahally-Pacharr and a study of cooperatives, among other duties. To be able to design, carry-out and analyze a broad range of studies, Mr. Jammeh will need at least a master's degree in sociology.

The SEU recruited and trained 23 enumerators, 1 senior supervisor and 1 junior supervisor. Later, they provided training in data entry operations at this micro computer facility. There was extensive recurring training in field data collection using sample survey techniques. Sighteen of the enumerators are now placed with PPMU and they have received further training in the data collection requirements and precedure for the National Agricultural Sample Survey and the Gambia Agricultural Data System.

As MFF developed its micro-computer center, short courses were provided on BASIC language, lotus 1-2-3, word processing and statpac.

Over-all, MFF provided excellent, if initially very strict, training for its SEU field staff. It remains to be seen whether they can or will be efficiently utilized within PPMU.

Mariatou Faal was trained in Agricultural Policy for 4 weeks in July 1985 and received a certificate to acknowledge completion of the one month session. Certainly, that brief exposure is not adequate to gain an effective, workable knowledge of a very important and complex issue like Agricultural Policy. Ms. Faal is currently on a 30 month training assignment in Australia.

Long-term degree training in range management was a combination of in-Africa and in-U.S. formal training. Two individuals attended Egerton College in Kenya where they obtained certificate level training in Range Management. This was not funded by MFF but was just prior to the initiation of MFF. After a short period of on-the-job training in The Gambia, one of these individuals was sent to CSU to do a B.S. in Range Science. A special shortcourse included a visit to Southwestern U.S. He returned to the project in 1983 with practical Africa related training from Kenya and theoretical training from the U.S.A. He has now served as Range Counterpart for two and a half years practicing in his speciality. The second trainee returned from Kenya and served as Range Counterpart for three years, utilizing his practical African training from Kenya in The Gambia. He will return from CSU in June 1986 with a B.S. degree. Special short courses which he attended were the two month USDA sponsored one at New Mexico State University on Range Management and a one month tour of range livestock production and research programs in Florida.

The quality of the combined African and U.S. formal coursework, coupled with several years of practical experience on the MFF, has been excellent. The participants are capable of conducting individual tasks in range management, such as range inventory or range seeding. They have little experience, however, at planning individual projects. Nor have they experience in planning and implementing of an entire range livestock programs for the country as a whole. Their formal training needs to be upgraded to prepare them for this task. They also would benefit from outside guidance once they are in this position of national planning and implementation.

The Pasture Assistants active in MFF are individuals with less than a high school diploma. After employment by DAHP they attended a 15 month program at Abuko Training School where they were presented with some basic principles but were involved primarily with practical exercises in the livestock production and veterinary medicine areas. They have stated that this was very inadequate in depth. Their entire training in range management has been on-the-job training with MFF. The annual workshops conducted by MFF were very multidisciplinary in nature and allowed an integrated application of principles learned. In addition, the range livestock component conducted numerous other short workshops in seed production at YBK and Giroba Kunda and in rangeland resource inventory and field mapping prior to the work done in MID and URD. The most

significant training obtained by the Pasture Assistants, however, was the daily field contact with the Range Management Specialist. This provided the necessary transition from theoretical workshop training to implementing action programs in their areas.

Overseas training and then their orientation in applied research or field work in The Gambia was excellent for the maize agronomist. However, in the forage program, an appropriate textbook training has been provided but the orientation in conducting skillful and applied forage or field research is lacking.

D. Recommendations

Numbers of employees within the Ministry of Agriculture (MOA) are excessive. Reports indicate that there is one MOA employee for approximately every 17 farmers in The Gambia. One cannot suggest more personnel be added, therefore; but it might be advisable to shift the location and duties of those individuals. The reader is referred to a study conducted by PPMU and USAID which deals with this issue in much more detail (Amann and Snyder, 1984). What is needed foremost is the upgrading of the level of training of these individuals. Of over 2000 positions in MOA there are 32 with a B.Sc. degree, 27 M.Sc. degree holders and no one with a Ph.D.

Degree training is needed to upgrade Certificate and Diploma level personnel to the B.Sc. degree level in large numbers. Selected B.Sc. degree holders must be upgraded to the M.Sc. degree level.

In-service training for Pasture Assistants, Agriculture Demonstrators, Livestock Assistants, and Enumerators, as has been conducted by MFP, is essential.

ANNEX E

ECONOMIC AND TECHNICAL NOTES AND REFERENCES

1. Farm Budgets for Maize and Competitive Crops (Millet, Sorghum and Groundnuts)

Farm budgets are generally developed for specific purposes. As a result, they show considerable variation in derived results. The variability in itself is not too disturbing if the contributing factors are carefully completely documented and understood. Some of the factors leading to what appear to be contradictory results may be cited as follows:

First of all, the time period for which a budget is derived may be calculated with prices and costs existing at that specific time. Subsequent changes in prices and costs call for appropriate adjustments to the budget. Note that the GPMB budget uses an import U.S. maize parity price. Then too, there is the matter of variability in regional rainfall patters, when and where budgets are developed extent of use of animal traction, and implements used is another variable. Moreover, fertilizer formulations introduce a very significant variable in fertilizer trails; not only the amount applied, but the nutrient composition is very important.

Seed applications vary according to density of plants, width of rows, size of seed, and even germination percentages. Prices also vary for improved seed versus home grown seed.

Cost of bags and transport may also be considered in some budget and not in others. Then there is interest on capital investment as is shown in GPMB budgets. Labor cost is another variable that makes a big difference in net returns to an enterprise. In some studies labor is assumed to have an opportunity cost of zero, and is omitted from the calculations.

The variables just mentioned may be observed in the comparison of two maize budgets shown in Table E-1 One was prepared by GPMB and the other provided by MFP. Note that the former is for 1984/85 and the latter for 1985/86. Accordingly prices and unit costs vary. Twice as much seed is used in the GPMB budget compared to the MFP recommendation. The former also includes a cost for bags and interest, not included in the latter. Fertilizer applications in the latter instance are three times higher and twice as expensive. In the final analysis, one must be aware that one budget does not serve every purpose.

In The Gambia, there are 50 or more soil series which could respond differently to fertilizer applications.

The benefit/cost ratio is another element of cereal production that deserves comment. Comparing benefit/cost ratios can be misleading unless used in a marginal sense, that is, how much benefit is realized from a given increase in cost? For example: 100/10 and 1000/100 have the same benefit cost ratios 10 to 1, but in the first set there is a net of 90 compared to 900 in the second set. The key is to compare marginal returns to marginal costs.

Under existing circumstances appropriate data are not available with which to derive benefit/cost ratios for competing cereal grains. In addition, it is necessary to say that gross incomes per hectare are not good measures of benefits unless one is willing to ignore the cost of inputs.

TABLE E-1

1984/85 Farm Budget for Maize

	D/Hectare
Revenue (D765 x 1.433 MT)[a]	1096
Oxen	21
Fertilizer: 98 kg NPK @ D.92/kg	90
Seed: 42 kg @ D.96/kg	40
Bags: 5 bags @ D2.88 per bag[b]	14
Interest: 6 months @ 15%/year	12
Return to Labor	919
Return per may day (54 days)	17.02
Return per July-August man day (17 days)	54.06

SOURCE: GPMB data.

[a]The maize price is based on import parity with U.S. maize.
[b]Bags are assumed to last three years.

TABLE E-2

1985/86 Farm Budget for Maize as Estimated by MFP

Yield (Tons/ha.)	2.5
Price (D/ton)	800
Value of product (D)	2000
Seed (D)	20
Fertilizer: 200 kg. 15-15-15 @ 30/50 kg.	120
100 kg/urea @ 34/50 kg.	68
Labor 60m/d @ 1.75	105
Total variable cost (D)	313
Net return (D)	1687

TABLE E-3

Benefit/Cost Ratios for the Maize Program

It is difficult to arrive at meaningful benefit/cost ratios when the available data are unreliable. for example:

	Spencer, Mktg; Survey, p.6	Gaie, et al Eval. of Maize Technology P.9	Kidman Trials at Sapu 1981 (P.B11)
Prod. in (ton/ha.)	1.26	2.05	1.63
Var. cost (D/ha)	11.8	77.79	with 0 fertilizer
Cost of labor 53.2 man/days	-	-	
Seed	-	-	4.4+
Farm gate price (D/ton)	1250	600	With high rates of fertilizer.
Gross income Price X Prod'n (D/ha)	1575	1230	No cost or price data.

In the Spencer report (Reference 44) there is no mention of fertilizer applications. The variable cost of D11.8 per ha. must be an error as it is less than applied on millet or sorghum crops. Farm gate price is extraordinarily high, which makes both net and gross income unusually high.

In the Gai et al report (Reference 15), at low application rates, 38.1 bag/ha. of fertilizer were applied and resulting yields were higher than when 458.1 kg/ha. was applied, 2.5 tons and 1.63 tons per ha., respectively.

In the Kidman report (Reference 19), trails at Sapu 1961, showed 1.63 tons/ha yields with no fertilizer and with liberal amounts of fertilizer applied, yields of more than 4 tons/ha. were realized. In this latter instance no cost or price data were applied to the test results. One expects that there will be greater clarification in the U.S yet, incompleted maize report. The Farm management studies will include farm and crop budgets.

2. The Economic Merits of the Maize Fertilizer Trials

It is difficult to evaluate the economic merits of the maize fertilizer trials because, as reported in reference No.13 p. 6, participating farmers failed to follow recommended fertilizer applications. Results were open to question, as were also the performance of demonstrators in favor of higher than expected yields. These disparities are quite obviously shown in Table 3, p.7, of the stated reference for which data were obtained by both the SEU enumerators and agricultural demonstrators. Measured yields from the same Nafo members, applying the same amount of fertilizer, showed added yields from fertilizer by SEU measurements to be 180 kg/ha. compared to 1310 kg/ha. reported by the agricultural demonstrators.

In Table 4, P.9, of the same publication puzzling results were portrayed i.e., higher yields resulted when lower rates of fertilizer were applied. Then on P. 12 of the same publication, there is a statement to the effect that "high rates of fertilizer result in greatest yield and gross margin".

As indicated in the publication, the above cited maize fertilizer results are confusing. Part of the problem is the difficulty of communicating with farmers and getting their understanding and cooperation. Any further trials should be carefully planned, closely supervised, and constantly monitored.

3. The Technical Scope of the Project relative to Collection and Analysis of Production and Marketing Data

Numerous reports and publications have documented the collection and Analysis of Production and Marketing Data. Many of these were prepared with the cooperation of GOTG, particularly with the Ministry of Agriculture and PPMU. In this latter instance, it should be noted that the MFP in cooperation with PPMU established a Marketing News Service which is discussed in more detail in another section of this report.

Another important aspect of collection and analysis of production and marketing data is that of training the collectors and analyzers. The MFP, throughout its existance selected enumerators, provided training sessions and workshops, and supervised their activities. Similarly many counterpart staff personnel were given opportunities to attend universities overseas for graduate degree training, also to attend national and international conferences and workshops to broaden their scientific knowledge and skills.

Some of the more pertinent reports and publications dealing with collection and analysis of production and marketing data are listed here by author(s) and title only. These may be found in bibiliographical form in the List of References.

1. Gai, Jammeh and Patrick, Evaluation of Department of Agriculture/MFP Maize Technology as used by Farmers.

2. Kidman and Owens, The commercialization of Maize in The Gambia.

3. Patrick, Jackus and Jabang, Gambia Agricultural Data Systems User's Manual.

4. PPMU, Planning Programming and Monitoring Unit for the Agricultural Sector.

5. Spencer, The Gambia Maize Marketing Survey and Consultant Report.

6. Spencer, A Handbook of Graphs and Tables of Market Prices of Selected Agricultural Prices in The Gambia

7. Eckert, The Gambian Cattle Herd, a Survey Report.

8. Hedrick and Bojang, Final Report of the Forage Agronomist Mixed Farming Project.

9. MFP, Two year Findings of Base Survey; Russo, Patrick and Deffendol, conducting village level Feeding Trials.

10. PPMU/MFP. Social Monitoring Reports (2 published - 3 in process).

4. The National Livestock System

The national cattle herd is predominantly of the N'Dama breed which is tolerant to trypansosomiasis. This disease limits the introduction of other breeds, none of which are as tolerant to the Tsetse fly as the N'Dama. Cattle may be found among most tribal groups but the Fulas have the strongest husbandry.

The Gambian cattle herd is estimated to number about 300,000 to 330,000, based on growth data since the late 1970s. Assuming that currently there are about 330,000 head in The Gambia, the annual offtake would be approximately 22,000 animals (offtake refers to net sales plus slaughter). With this assumption and an assumed average value of D400 per animal offtake, the total value of sales from the cattle herd would be D8,800,000. It is estimated that the offtake could be doubled through carefully planned management of the herds. This means providing better nutrition, health care, and watering points. Livestock specialists maintain that without increasing the size of herd, effective management could double the offtake by reducing calf mortality, increasing the calving rate and also reducing adult mortality.

Unfortunately, there are no recent data to indicate the number of livestock in The Gambia nor the number affected by the MFP Program. The last cattle census of 1977/78 reported a total of 298,000 head, of which over 15,000 were plough oxen and the rest were Ndama cattle with a few Gobra. Thus, it is impossible to determine whether there has been any impact upon the total food production in The Gambia resulting from livestock improvement since the introduction of the MFP. However, the Department of Animal Health and Production estimates the total number should be the same as for the 1978 census.

The relationships between livestock and land, and also between livestock and The Gambian people, are shown in the following data:

TABLE E-4

The Gambia

Man/land ratio	0.63
Tropical livestock Units/capita	0.522
Cattle, head/ha. (total land)	0.292
Cattle, head/ha. (non cropland)	0.348
Meat production	
Kg./ha.	7.0
Kg/TLU	21.3
Kg/capita	11.1
Milk Production	
Kg/head	17.1
Kg/capita	7.9

Tropical Livestock Unit.

Sheep and goats combined also number an estimated 300,000 head. About 30 percent of rural compounds own small ruminants.

Competition for forage during the dry season becomes very critical. Animals may lose up to 30 percent of body weight before relief comes with the rainy season. In severe drought periods many cattle die from starvation. Thus, conservation of forages become very important. With limited stover supplies, draft animals are usually given preference in receiving limited feed supplies.

Livestock complements grain production in a number of ways, providing: manure for soil fertility, draft power, (donkeys, horses and oxen), transportation, food in the form of milk and meat, and a form of savings and insurance for the owners.

Every Gambian has the right to graze livestock on the uncultivated bush lands, essentially a common free range. After crops are harvested, even crop residues become free range for common grazing.

5. Land Tenure and Use of Land

Private land ownership is now allowed in urban areas while landholding in rural areas is governed by tradition and custom. Administration of land tenure is handled by the Ministry of Local Government at the national level. The Divisional Commissioner and District Chief, and the Alkalo (village head) govern at the local level. Most land is already allocated but compounds can obtain rights to cropland by clearing unused land. Land obtained in this way can be passed on for use by heirs but ownership is not transferable. Compounds where preemptive rights to land use have existed for many years find that little or no uncleared land remains to accomodate a rapidly increasing population. Thus, it is common practice to borrow cropland from other compounds. Moreover, seasonal workers returning to farm crops during the rainy season offer their labor in return for a parcel of land on which they grow a cash crop. If a landholder leaves the village for whatever reason, his land may be loaned to relatives or assigned to other compounds until he returns, reclaims and uses it.

Most livestock owners keep livestock in their own village grazing area. On occasion, however, they may be herded great distances, even into Senegal in search of grasses.

In the 1982 MFF baseline survey of 582 heads of households, 240 (40%) indicated they had sold cattle in the previous 12 months. Those who sold cattle, further indicated that they sold 7% to the Gambian Livestock Marketing Board, 79% to private traders and the remaining 14% to relatives or friends.

There are three groups of buyers for marketed cattle: (a) the established merchants, (b) smaller dealers who speculate and buy at LMB buying points, and (c) the butchers who buy as the need arises from nearest market points.

The LMB's central abbatoir is located 25 km southeast of Banjul near Abuko. Services include slaughtering, dressing, inspection and delivery to a shop or market. This abbatoir is the only supervised slaughter location for animals processed for public consumption.

Prices for cattle are usually negotiated openly a day or so before slaughter. Often there are intermediaries who negotiate for the seller, with the owner retaining the right to reject or accept any offers.

6. The Livestock Marketing Board (LMB)

The LMB is a parastatal body established by act of parliament in 1975. Its functions are to:

a) Maintain regular and sufficient supplies of livestock for marketing in The Gambia and promote export of livestock when supplies exceed domestic needs.

b) Assure the best and most economical arrangements for purchase, grading, sale and export of livestock.

c) To assist in any way, subject to approval by the Minister, in the development of the livestock industry.

In the Banjul area, cattle are slaughtered at the abbatoir late at night or early morning of the day before it is to be sold. The carcass is not chilled. Meat is delivered by insulated meat van to urban butcher's stalls early in the morning. Refrigerated storage is almost non-existant.

In the provinces, or at village level, there is very little marketing of beef. Most meat consumed comes from sheep, goats, or poultry. Beef appearing in the market is most likely to be from the older, weaker or barren animals.

At time of slaughter, the animal is skinned and butchered; the entrails are processed; the internal organs are all delivered with the carcass to the butcher/owner. A daily record is kept of hides and skins by name of each owner for payment at the end of each month.

There are official government prices for rural areas and for urban areas. In February 1986 these prices were as follows, per kilogram:

	Rural Areas	Urban Areas
Steak	D 7.00	D12.00
Meat with bone	D 5.50	D 8.00

Cattle prices follow a seasonal pattern. Prices are lower during the beginning of the rainy season and highest at the end of the rainy season. The explanation probably lies in the fact that the beginning of the rainy season is also the hungry season, a time when rural people need money and tend to sell more animals at this time than others; Thus, the increased sales at the market cause prices to fall.

When considering the value of livestock, one should not ignore the contribution of manure to fertility of the soil. Manure is especially valuable to farmers in The Gambia because other fertilizers are very expensive and at times difficult to obtain. Even farmers, who do not have livestock of their own, may offer to pay a cattle owner to tether cattle in their field. The payments are quite variable. One farmer paid four cartloads of groundnut hay (D60) and D15 cash to have 45 cattle tethered in his fields for two weeks. Another farmer paid two horse-cart loads of groundnut hay (D34) for 20 cattle to be tethered in his fields for three weeks. Based on nutrient content of cattle manure, it is estimated that, at current fertilizer prices, the value of the manure would be between 5 and 15 dututs per day per animal. At this price the fertility contribution of manure by the national cattle herd would be about D900,000.

In addition to the contribution of manure, there is also the important contribution of milk for human consumption. It has been estimated that of the 300,000 cattle making up the national herd, about 56,900 would be lactating each year. At 0.64 litres per day per milked animal, for about 200 days of lactation, this gives a total of over 7 million litres of milk available each year for human consumption. With a January 1986 price of D1.25 per litre, the available milk could be valued at more than D9 million.

7. The Economic Feasibility of Fattening Cattle and within Existing Farming Systems

This appears not to be economically feasible at this time. A cattle feeding trial was initiated on December 20, 1982 at the Yundum farm yard. It consisted of eight four-year old N'dama bulls divided at random into two groups of four bulls each labeled as Group A and Group B.

Group A was limited to groundnut hay and Group B was started on a ration of groundnut hay plus maize grain. Both groups had continual access to fresh water and mineralized salt.

Groundnut hay was fed ad-libitum daily to both groups during the trials. Ground maize grain was fed to Group B sparingly at first, then gradually increased until the quantity consumed was about equal to the quantity of hay being consumed. The combination ration of maize grain and groundnut hay leveled off at about 3.5 kg. and 4.0 kg respectively, per day. The Group A ration leveled off at about 5.0 kg. of groundnut hay per day. Excess feed left in the bins was removed, estimated to be about one-third of the quantity fed. All the feed was weighed and fed daily in one feeding. The uneaten feed was also weighed.

The trial ended after completing a nine week feeding period. Group A finished with an average per animal weight gain of 22.5 kg. and Group B with an average gain of 51.25 kg., making an average daily gain of 0.36 kg. and 0.81 kg. respectively. The net loss per animal from feeding maize grain was about D4.95 in Group B.

TABLE: E-7
Summary of Feeding Costs and Animal Gains for a 63 Day Feeding Period.

Item	Group A (Groundnut Hay only)	Group B (Groundnut Hay & Maize
1. Initial weight (kg./animal)	188.6	207.5
2. Final weight (kg/animal)	211.3	258.8
3. Total gain (kg/animal)	22.5	51.3
4. Weekly gain (kg/animal)	2.5	5.7
5. Daily gain (kg/animal)	0.36	0.81
6. Groundnut hay consumed		
a. Total (kg/animal over 63 days)	317.1	224.0
b. Daily (kg/animal)	5.03	3.56
7. Maize grain consumed		
a. Total (kg/animal over 63 days)	-	181.4
b. Daily (kg/animal)	-	2.88
8. Cost for 63 days feeding		
a. Groundnut hay* (Dalasis/animal)	D31.70	D22.40
b. Maize** (Dalasis/animal)	-	D70.75
c. Total feed costs	D31.70	D93.15
9. Cost per kilogram of weight gain	D1.42	D1.82
10. Value of weight gain***	D44.10	D100.56
11. Ratio of Benefit to Cost of Feed Alone	1.39	1.08

Added Return:
(51.3 kg - 22.5 kg) @ D1.96/kg) D56.50

Changes in Cost:
Cost of Maize grain (@ D390/t.) D70.25
- Savings on Hay (@ D100/t.) - D9.30
Net Cost D61.45

Net Loss per Animal D4.95

* At an assumed price of D100/ton
** At GPMB price of D390/ton
*** Eight bulls were purchased for the trial at an average liveweight price of D1.96/kg. This price was used.

NOTE: Labor and costs other than feeds nominally associated with animal feeding were not taken into consideration in this feeding trial.

There is very little difference in costs of shipping between nearby points and distant points.

TABLE E-5

Transport Costs for Shipping Livestock from Rural Points to Banjul

(Type of Livestock	(Dalasi per Head)
Cattle	25 to 35
Sheep	5.0
Goats	5.0

Cattle and beef products occasionally enter into the export market. In 1983 for example, 650 cattle were shipped to Nigeria. In 1984, almost 1200 cattle were sold to Gabon. A fairly large quantity of meat, some 32 tons, were shipped to Sierra Leone in 1985.

Assuming that 300,000 head of cattle make up the national herd and that 80% are females and 20% males with weights of 200 kg and 250 kg respectively, then with females priced at D1.80 per kilogram and males at D2.25 per kg the total value of the herd would be over D120 million.

Gambia Cattle Buying Prices, 1985:

Prices for good quality slaughter stock, fully fleshed and rounded vary according to weights and sex as follows:

TABLE E-6

Prices Corresponding to Animal Weights

Animal Weight	Males	Females
	(Dalasis per Kg)	
150 to 199 kg.	2.00	1.60
200 to 249 kg.	2.15	1.80
250 to 299 kg.	2.25	2.00
300 up	2.50	-

Table: Marketings for Slaughter, Cattle, Sheep, and Goats, The Gambia, 1985

Type of Livestock	Males	Females
	(Members)	
Cattle	9702 (63%)	5734 (37%)
Sheep	462 (14%)	2783 (86%)
Goats	1286 (22%)	4504 (78%)

The Average Number of Livestock slaughtered per year over the Four Year Period 1982 - 85 are indicated as follows:

Cattle	11,702
Sheep	3,159
Goats	6,496

8. Evaluate The Success Of Market News

A market survey and analysis was conducted by the MFP marketing economist in late 1983. It was found that village traders and farmers used word of mouth as the principal source of market news for price formulation. Accordingly, it was apparent that reliable market and price information was needed for more effective market analysis and research. Market information not only facilitates trade by exposing prices, but is essential for inventory control and production planning. Moreover, accurate price data are necessary in developing and carrying out national marketing policies.

Without marketing information, local traders bargain for wider margins as a hedge against price drops in more distant markets. As a result the farmers are disadvantaged.

The market news service was originally intended to be part of the livestock and maize marketing effort of MFP and PPMU. In response to interest expressed by the FAO Coarse Grain Industry Team, The Gambian Produce Marketing Board and the Gambian Ministry of Finance, the market news activity was broadened in scope to include livestock, crops and fisheries. Both wholesale and retail prices are reported with some information on market supplies. In doing this, farmers, traders, and consumers may know what level of supply of commodities is on the market, when, where and at what price.

Compiling market news has its own set of problems. Data collection is done by three market reporters stationed at territorial intervals to permit each one to cover at least three or four markets in the western, middle and eastern geographic areas of the country. Data are collected on standardized forms and sent weekly to PPMU. Information is placed on an IBM PC computer and the Lotus Management System for processing. This may sound simple enough. In reality there are many logistical difficulties to overcome. Getting the data to Banjul on a timely basis is quite difficult. The rural telephone system is non-existent or unreliable in most of The Gambia. Moreover, periodic fuel shortages limit the extent of travel that is possible. Yet information must be available to meet the weekly schedule of presenting market news broadcasts.

After one year of operation, it was noted that maize, millet, and sorghum and rice are marketed almost entirely through the private sector. Groundnuts and cotton are marketed through government or parastatal channels.

MFF surveys indicate that about 10 to 15 percent of domestic production of maize, millet and sorghum enters the private marketing system - some 4000 to 6000 tons per year. The only public sector buying agent is the Gambian Cooperative Union (GCU) which is the authorized agent of the Gambian Produce Marketing Board (GPMB). GCU deals primarily with groundnuts and cotton.

How much the market news service really helps farmers is still a question to be answered. There are still problems of converting local measurement units to metric measures, of distribution of market news which now largely depend upon farmers having radios and an ability to interpret price information. Certainly, traders and marketing researchers will find this service very useful. In a 1982 baseline survey conducted by MFF, 16 percent of the compound heads interviewed had access to a radio, and agricultural broadcasts were included to in 66 percent of the programs.

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