

PDBAG617

685-0202

SENEGAL

RANGE + LIVESTOCK DEVELOPMENT

Project Paper

Amendment No. 8

FY 82

Part I of II

PROJECT DATA SHEET

1. TRANSACTION CODE

A = Add
 C = Change
 D = Delete

Amendment Number
eight

DOCUMENT
CODE
3

2. COUNTRY/ENTITY

Senegal

3. PROJECT NUMBER

685-0202

4. BUREAU/OFFICE

AFRICA BUREAU

06

5. PROJECT TITLE (maximum 40 characters)

Senegal Range and Livestock Project

6. PROJECT ASSISTANCE COMPLETION DATE (PACD)

MM DD YY
01 31 85

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

A. Initial FY 82 B. Quarter C. Final FY 82

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

| A. FUNDING SOURCE | FIRST FY | | | LIFE OF PROJECT | | |
|------------------------|----------|---------|----------|-----------------|---------|----------|
| | B. FX | C. L/C | D. Total | E. FX | F. L/C | G. Total |
| AID Appropriated Total | | | | | | |
| (Grant) | (1238) | (362) | (1600) | (1238) | (362) | (1600) |
| (Loan) | () | () | () | () | () | () |
| Other | | | | | | |
| U.S. | | | | | | |
| Host Country | | 245 | 245 | | 490 | 490 |
| Other Donor(s) | | | | | | |
| TOTALS | 1238 | 607 | 1845 | 1238 | 852 | 2090 |

9. SCHEDULE OF AID FUNDING (\$000)

| A. APPRO- PRIATION | B. PRIMARY PURPOSE CODE | C. PRIMARY TECH. CODE | | D. OBLIGATIONS TO DATE | | E. AMOUNT APPROVED THIS ACTION | | F. LIFE OF PROJECT | |
|-----------------------|-------------------------------|--------------------------|---------|------------------------|---------|-----------------------------------|---------|--------------------|---------|
| | | 1. Grant | 2. Loan | 1. Grant | 2. Loan | 1. Grant | 2. Loan | 1. Grant | 2. Loan |
| (1) SH | 140 | 078 | | 3125 | | 1600 | | 4725 | |
| (2) | | | | | | | | | |
| (3) | | | | | | | | | |
| (4) | | | | | | | | | |
| TOTALS | | | | 3125 | | 1600 | | 4725 | |

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)

021 022 063 095 319

11. SECONDARY PURPOSE CODE

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

A. Code BSW

B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

Effective, potentially replicable livestock production project implemented in the Bakel area.

14. SCHEDULED EVALUATIONS

Interim MM YY MM YY Final MM YY
0 3 8 3 1 2 8 4

15. SOURCE/ORIGIN OF GOODS AND SERVICES

000 941 Local Other (Specify)

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

1. Redefinition of project inputs and output.
2. Modification of work plan and budget.
3. Reassignment of management responsibilities.
4. Realignment of project zone boundaries.

17. APPROVED BY

Signature

David Shea

Title

Director, USAID/DAKAR

Date Signed

MM DD YY
1 1 2 0 8 1

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

MM DD YY

SENEGAL RANGE AND LIVESTOCK
Project NO 685-0202

Amendment Number 8

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ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR FOR AFRICA, ACTING

FROM: AAA/AFR/DB John W. Koehring

SUBJECT: Senegal Range and Livestock Project 685-0202

I. Problem: Your approval is required to (1) amend the subject project in accordance with the amended project paper, (2) extend the Project Assistance Completion Date (PACD) to January 31, 1985 and (3) add a covenant to the Project Agreement (ProAg) requiring the Government of Senegal to elaborate plans for the possible replication of the subject project. As a result of this amendment, it is planned that \$1.6 million will be obligated in FY 1982.

II. Discussion:

A. The subject project, authorized in December 1974 with a life-of-project funding level of \$3.125 million, responds favorably to the private sector involvement, transfer of technology and institution building guidelines set forth for AID projects. The purpose of the project--development of a potentially replicable, effective, privately operated livestock system--is to strengthen local institutions and influence Senegalese Government policy concerning range management. The core of this multi-faceted project is the introduction of a new technology which consists of construction of low-cost, water-collecting ponds strategically located across the range of the project area. These ponds serve as cattle watering points.

It is hoped that this livestock production model will become equally valid for application in other parts of Senegal and in other Sahelian States where losses to national herds caused by drought have been severe. Thus, the project is at once practical (increase in livestock productivity) and research/policy oriented (creation of a replicable model). These dual aspects make this project capable of achieving significant results.

The process leading to the submission of this amendment has been logical and encouraging: drawing upon five years of field implementation, an evaluation was performed which determined that the project was sound in goal and purpose and provided the feedback for the modifications described in the amendment text. These modifications are designed to reinforce and refine those project activities which are contributing to our desired impact while eliminating those of marginal value. It is anticipated that implementation of this amendment will permit completion of activities needed to remove constraints to expansion and improvement of the traditional livestock system.

It is for this reason that this amendment period is essential: for while we believe that ponds and other interventions can be effective, we will not know what effect these interventions will have on the full range system (and the attitudes of herders that utilize that range) until completion of all the activities proposed for the amendment period. Failure to move forward now will jeopardize the validity of what we have accomplished to date at a time when such an investment could plausibly enable us to achieve our intended impact.

The amendment modifications are contained in a \$1.6 million PP amendment submitted by USAID/Senegal: Specifically, the amended activities are:

- 1) Reorganization of project management to place responsibility for administrative and financial management squarely in the hands of the Department of Health and Animal Production. The role of the Ministry of Welfare (Promotion Humaine) will be limited to literacy training;
- 2) increase of the managed grazing reserve from 110,000 to 150,000 hectares;
- 3) location and construction of 10 additional ponds for cattle watering;
- 4) initiation of a system to provide herders with information on current range conditions and market prices;
- 5) improvement of village water supply through repair of several existing wells and possible construction of new wells;
- 6) construction of an additional 62 kilometers of access roads;
- 7) continuation of delivery of preventive animal health packages comprised primarily of vaccinations and supplements of salt and mineral to cattle diet;
- 8) institution of a family milk program which involves feeding of cattle for purposes of milk production rather than steer sales;
- 9) limited assistance in livestock marketing during seasons when herders are in a weakened negotiating position; and
- 10) establishment of a project monitoring and evaluation unit to provide relevant data collection and assessment for project decision makers.

B. Implementation of the above amendment activities will require an additional expense of \$1,6 million. An overall breakdown for these funds follows:

| | Amendment Period (\$000) | | Life of Project (\$000) | |
|--|-----------------------------|------------|----------------------------|------------|
| | <u>AID</u> | <u>GOS</u> | <u>AID</u> | <u>GOS</u> |
| 1. Technical Assistance (probable contract with Title XII BIFAD institution) | 685 | - | 1,338 | - |
| 2. Training | 159 | - | 666 | - |
| 3. Construction | 294.75 | 311 | 1,227.75 | 451 |
| 4. Commodities | 107 | 54 | 691 | 54 |
| 5. Revolving Fund and Feeding Supplies | 58.60 | - | 255.60 | 100 |
| 6. Operating Costs | <u>295.65</u> | <u>125</u> | <u>521.65</u> | <u>125</u> |
| TOTAL | <u>1,600.00</u> | <u>490</u> | <u>4,700.00</u> | <u>730</u> |

C. Socio-economic, Technical and Environmental Description

1. The project has demonstrated its socio-economic acceptability during implementation.
2. Senegal is a democratic country with an excellent record on human rights and no issues of concern to the U.S. exist in this regard.
3. The technical soundness of the amended project activities has been demonstrated during implementation.
4. A full environmental assessment was completed and no further analyses are necessary.

D. Other Items

1. Covenant

The Government of Senegal (GOS) agrees to submit to USAID within one year of the signing of the ProAg amendment a detailed set of criteria by which it will determine if activities undertaken by this project are, indeed, replicable in other parts of Senegal. Estimates of recurrent and implementation costs associated with any attempt to replicate project activities will also be included. Finally the GOS will inform USAID of the factors influencing its deliberations on the issue of replication.

2. Extension of the PACD

The PACD for this project will expire on December 31, 1981. As a result of the redesign of the project, implementation will now extend past that date. It is, therefore, requested that the PACD be extended until January 31, 1985.

3. Implementation Plan

The implementation plan for the project has been reviewed by the Project Committee which believes it sets forth a reasonable timeframe in which to carry out this amendment.

4. Implementation Agencies

This project is being implemented by the Office for Health and Animal Production of the Ministry of Rural Development, Government of Senegal and the Agriculture Office of USAID/Senegal.

5. Project Committee Action

Project committee meetings took place in May and July culminating in the Project Review held August 25, 1981. The consensus of the Project Review was to recommend amendment approval and authorization by AA/Africa pending inclusion of certain additional financial and project information. Such inclusions have been made in accordance with the wishes of the Project Review. An ECPR, held December 2, 1981 under the chairmanship of Acting AA/AFR, recommended approval of this amendment.

E. The requirements of Section 611(a) of The Foreign Assistance Act of 1961, as amended, are considered fulfilled when the Project Committee recommends approval of the project by the AA/AFR.

F. Officers Responsible for this project are:

John Balis
Agricultural Development Officer
USAID/Senegal

Joel Schlesinger
Project Officer
AFR/DR/SWAP

III. Justification to the Congress

The Congress was informed of this action in an advice of program change dated December 4, 1981.

IV. Recommendation:

That you sign the attached project amendment authorization thereby: (1) amending the project in accordance with the revised project paper and budget; (2) extending the PACD to January 31, 1985 and (3) adding a covenant requiring the GOS to elaborate plans for the possible replication of the subject project.

Clearances:

DAA/AFR:WHNorth WHN
AFR/DR:NCohen NC
AFR/DR/SDF:JHester (draft) JH
AFR/SWA:FJohnson FJ
AFR/SWA:FGilbert FG

AFR/DR/SWAP:JRMcCabe JRM
AFR/DR/ARD:CScherrer (draft) CS
AFR/DR/ARD:LAbel (draft) LA
GC/AFR:LDeSoto (draft) LD

Drafted by: AFR/DR/SWAP:JSchlesinger:fn:11/10/81: ext 28242

PROJECT AUTHORIZATION AMENDMENT

Name of Country: Senegal

Name of Project: Range and Livestock Development Project

Number of Project: 685-0202

1. Pursuant to Section 121 of the Foreign Assistance Act of 1961, as amended, the Range and Livestock Development Project for Senegal was authorized on December 20, 1974. That authorization is hereby amended as follows:

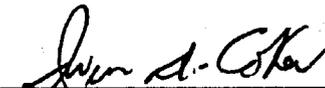
a) Life of Project (LOP) funding is increased by \$1.6 million from \$3.125 million to \$4.725 million;

b) The Project Assistance Completion Date (PACD) is extended from December 31, 1981 to January 31, 1985.

2. The Grant Agreement Amendment will provide in substance that the Government of Senegal (GOS) agrees to submit to USAID within one year of the execution of the Amendment a detailed set of criteria, including estimates of recurrent and implementation costs, by which it will determine if activities undertaken by the project are replicable in other parts of Senegal, and the factors influencing its determination.

3. The authorization cited above remains in force except as hereby amended.

Date: 12/10/81



Irvin Coker
Acting Assistant Administrator
for Africa

I. Summary Description of the PP Amendment

The process leading to the submission of this amendment has been logical and encouraging: drawing upon five years of field implementation, an evaluation was performed which determined that the project was sound in goal and purpose and provided the feedback for the modifications described in the amendment text below. These modifications are designed to reinforce and require those project activities which are contributing to our desired impact while eliminating those of marginal value. It is anticipated that implementation of this amendment will permit completion of activities needed to remove constraints to expansion and improvement of the traditional livestock system.

A. Project Goal

Productive capacity of the Senegalese national livestock sector increased and stabilized.

B. Project Purpose

Effective, potentially replicable livestock production project implemented in the Bakel project area.

C. Summary of the Project

The Senegal Range and Livestock Project responds favorably to the private sector involvement, transfer of technology and institution building guidelines set forth for AID projects. The purpose of the project--development of a potentially replicable, effective, privately operated livestock production activity--is to strengthen local Senegalese Government influence institutions and policy concerning range management. The core of the project is based on the introduction of a new technology which consists of construction- low-cost, water-collecting ponds strategically located across the range of the project area. These ponds serve as cattle watering points.

It is hoped that this livestock production model will be equally valid for application in other parts of Senegal and in other Sahelian States where losses to national herds caused by drought have been severe. Thus, the project is at once practical (increase in livestock productivity) and research/policy oriented (creation of a replicable model). These dual aspects make this project capable of achieving significant results.

The basic unit of the project is the range area. Under this extension the boundaries have been drawn to include the tract of land within the full grazing range of the target groups. The boundaries are based upon recommendations of the target group, government officials and the nature of the terrain. The locations of ponds within this range area have been chosen initially to provide a dispersion of watering points consistent with the technical potential for collection and retention of rainfall. During this extension period, ten additional ponds are to be constructed and the site selection process of these ponds is to include the recommendation of herders regarding the merits of alternative sites. The improved access to water throughout the full grazing range is expected to increase the effective capacity of the range. It is for this reason that this amendment period is essential: for while we believe that ponds and other interventions can be effective, we will not know what effect these interventions will have on the full range system and the attitudes of herders that utilize that range until completion of all the activities proposed for the amendment period. Failure to move forward now will jeopardize the validity of what we have accomplished to date at a time when such an investment could plausibly enable us to achieve our intended impact.

In order for farmers to efficiently utilize the additional range capacity, the project will provide assistance to improve animal health and management. Of the several practices introduced in the initial phase, the extension will improve the coverage of basic health care and the use of mineralized salt feeding. These practices have relatively low cost with high apparent returns.

The initial project design provided for the construction of a network of fire control roads and other fire control facilities. During the initial work it has proven impractical to effectively organize fire control, but the utility of the fire lanes as access roads has become apparent. Consequently, fire lane construction is being altered to facilitate travel within the zone. Also, village attitudes and capabilities in fire control will be studied further to explore alternatives that might increase effectiveness and participation in protecting the range.

During the extension period, herd productivity is to be increased in two ways. First, cattle herd size is expected to grow modestly with growth rates of individual animals improving as well. This should combine to produce improved returns from marketed animals. In addition, improvement in milk production is also anticipated with consequent benefits to the nutrition of herder families. A limited supplemental feeding program will be used for milk cows, and both cost and benefit of this program are to be monitored.

The complete program thus forms a field laboratory for the perfecting of this promising technology for improved range production. The social component of this technology will be carefully analyzed during the extension period for the purpose of establishing the basic design requirement for further applications of this technology in Senegal or wherever similar range and weather conditions prevail. It appears that this pattern of range development could be followed for the grazing areas of much of the Sahel.

Certain of the infrastructure facilities constructed under the initial phase of work will be used for quite different purposes in the extension. Experience has shown that earlier expectations for centralized training and services are impractical at this stage. One can visualize a trend of cattle production that may at some future date take greater advantage of these facilities, but during the course of the next phase they will be somewhat under-utilized as the headquarters for this project. Alternate uses in government and social services are possible and are under consideration.

The primary target group of this project was the small herder in the Bakel areas of Eastern Senegal, where the average number of cattle per herder was estimated at between 15 to 25.

II. Background, Progress and Evaluation Findings:

A. Description of Existing Project

1. Project Description: The original project involved the establishment of a managed grazing reserve of approximately 110,000 hectares through the development of water resources, the establishment of a comprehensive, animal health control program, the construction of fire breaks, and the provision of limited technical assistance and participant training.

The project was to provide for year-round grazing on a controlled rotational basis for approximately 16,000 animal units through: (a) the establishment of active and passive fire prevention measures; (b) the strategic location of watering facilities within the project area; and (c) the establishment of an approved animal health program within the project area.

A major economic benefit envisioned for the project was a substantial increase in livestock production as a result of higher fertility rates, decreased mortality rates and improved growth rates. A second major economic benefit was to be a substantial increase in milk production, which was expected to double within 2 to 3 years. Other plausible benefits, not all quantifiable, included range maintenance, improved nutrition and health, and increased family income.

2. The project comprised the following inputs:

a. Fire Prevention

1. Firebreaks - This involved the provision of equipment for the construction and annual maintenance of approximately 500 km of firebreaks within the project area. Construction was to be carried out with a combination of capital and labor intensive technology.

2. Fire Suppression - This involved (a) the construction of lookout towers and (b) the provision of miscellaneous equipment (e.g., walkie-talkie radios, backpack water pumps, portable high pressure pump units, hand tools etc...) for volunteer fire-fighting units.

b. Livestock Water Development

The project was to construct and maintain up to:

1. 12 earth reservoirs
2. 5 sand reservoirs
3. 30 deep pits
4. 40 shallow-dug wells
5. 4 deep wells
6. 4 water spreading dikes

c. Animal Health

This involved strengthening the Livestock Service of the Ministry of Rural Development and Hydraulics to enable it to carry on a sustained campaign to vaccinate project area animals. The following construction items and equipment were to be provided:

- (a) 3 veterinary posts.
- (b) 10 vaccination corrals (8 cattle/2 sheep-goats).
- (c) 2 quarantine posts.
- (d) Equipment and medicine for 16,000 animal units (e.g. vaccines, lab equipment, transportation equipment, identification and handling equipment, etc...).

d. Technical Assistance

Financing advisory services of long-term and short-term consultants as follows:

- (a) Long-term Consultants - six and one half years of long-term technical assistance was to be provided.
- (b) Short-term Consultants - Sixteen man months of short-term consulting time was to be provided excluding design and evaluation.

e. Participant Training

The provision of non-degree academic/practical, observational and in-country training for the following positions was planned:

- (a) Academic/Practical Training for five project personnel.
- (b) Observation training of 4-6 weeks for five central government personnel.
- (c) In-country training as necessary for operational personnel under the project.

3. Promotion Humaine

In March, 1976, an amendment to the Project Grant Agreement was executed to increase project funding by \$400,000 in order to finance Promotion Humaine activities in the project area. The rationale was: "a supplemental goal of the project, in addition to that described in the original project agreement, is to assure that the people involved in the project are prepared both to manage and maintain the improved range management system as well as to use the increased revenues from the system to improve their living conditions."

The accomplishment of this goal, through the intervention of Promotion Humaine, was to come about through the latter's educational components termed:

- a. Sociological - a detailed data base survey of attitudes and practices.
- b. Orientation - preparing project staff and target population for project activities.
- c. Organization - assisting local population in forming relevant groups, cooperatives, etc...
- d. Complementary extension - preparing population to assimilate technical instruction.
- e. Instructional - teaching methods outside of livestock extension, per se, f.e., mother - child health care, vegetable gardening, poultry care, milk production and handling, functional literacy.

B. Evaluation Findings and Recommendations

A "Senegal Range and Livestock Development" Project Paper was approved in December 1974. It stated the following Project Purpose:

"To finance the cost of the equipment materials, construction, technical assistance, education training and research aimed at improving livestock production in the Toulekeddi/Sarre Zone near Bakel, Senegal. The project will provide a model for an integrated approach to livestock development which may be expanded to other parts of Senegal and the Sahel zone."

An April 1980 Evaluation of this project, forming part of the "USAID/GOS Joint Assessment," concluded that:

1. It did seem as if some of the equipment, materials and construction (in particular the ponds, as opposed to the buildings, 3 fire towers and firebreaks), had led to an improving of livestock production in the Toulekedé and part of the Sarre zone.

2. Much of the technical assistance, education, and training had not:

3. The result was that a "model for an integrated approach to livestock development which may be expanded to other parts of Senegal and the Sahel zone" cannot be said to have been provided.

4. Aside from a speculatively detailed design plan (CID 1975 report), little research had been brought to bear on this overall project purpose, such that the significant impact of the pond development would be difficult to replicate due to a lack of information about its more exact effects.

The evaluation listed several advantages to pond, as opposed to well, construction for improving range use:

1. Ponds open up range without causing a village to settle there and destroy the range through farming.

2. Ponds dry up before the onset of the new rains, forcing herds to rotate around seeking water wherever the first rains happen to have fallen in any given year. This prevents herds from grazing the same germinating, annual grasses in successive years - as would be possible if a permanent water source (a well) were there to save them the trouble of seeking out the location of the earliest rains.

3. Ponds take pressure off the range around natural ponds and provide a labor saving possibility for watering the animals.

Ironically, the IBRD - financed Eastern Senegal Livestock project left the Toulekedji zone for USAID to develop because of hydrogeological constraints on placing wells across its range. Hence USAID/CID came up with the fortuitous pond solution. Now the IBRD project has found that its new wells, because of their greater labor requirements, have not succeeded in drawing pressure off range around existing natural ponds and wells, even when they could provide access to less over-grazed pasture.

The present amendment, proposing one more year of funding for this project, is based upon these recommendations, contained in the evaluations:

1. Pond construction (9 cleared, 7 built with 700 meters of collection dikes) unfortunately is lagging behind the less directly useful firebreaks (137 Kms plus 183 Kms of improved road) and administrative centers (10 buildings each). Pond construction should be pursued according to engineering consultant plans. Further, pond construction should even be expanded where possible, i.e., on the Toulekedji plateau, to the south of the present project zone and into those areas not subsumed within the IBRD-financed Eastern Senegal Livestock project territory.
2. Project boundaries should be redrawn so that villages with geographical and historical links to the range served by these ponds would be systematically included as the range use plan is developed. Clean water infrastructure would be developed for these villages wherever possible.
3. An effective monitoring system should be fielded so as to accurately measure the effects of pond development on parameters of range condition, animal production, and family well-being.

This information could then be synthesized in order to better define the parameters for the replication of a pond-based range use scheme elsewhere in the Sahel. This exercise would also help technicians produce an applicable range use plan for the newly defined plateau project zone. This monitoring activity could be most effectively undertaken through a south-western agricultural university, working through the pastoral program at the University of Dakar and/or I'ENEA, that would field, with professional supervision, Senegalese and American graduate students to the zone.

4. The project administration, besides supervising range pond and village well construction, would be encouraged to continue its animal health and livestock production interventions on project herds.

5. Support for the role of Promotion Humaine should be reduced and redefined.

The emphasis of these amended efforts would be to refine the pond development package so as to make it maximally replicable elsewhere in the Sahel. The tendency in previous planning and implementation of this project to gravitate towards the integration of a broader scope of development interventions was not found to be financially, economically or managerially justified.

III. Description of Amended Project Activities:

There is an opinion among herders of the area-which is shared by project observers-that the ponds work: they collect water and enable wider utilization of the range at comparatively low cost. There were also a number of problems observed in the first phase, but perhaps the most serious weakness was the inability to provide quantitative information about the cost effectiveness of the new technology.

This extension of the project has been designed to 1) refine the application of the ponds to the specific range; 2) introduce range condition monitoring and managing techniques; 3) refine certain health and management services and 4) refine project management according to this set of objectives. This extension utilizes the basic resources introduced in the initial project, however certain features such as fire control and headquarters services have been greatly altered for the extension. It is anticipated that at the end of this extension reasonably firm data would be available to describe the costs and benefit of the complete range management scheme. Further, the herders should be on the way to following new grazing practices designed to utilize in a sound manner the expanded resources available to them. Improved animal care and management practices would further increase herd returns. These expectations include an assumption that the various changes in project operations can be readily completed and shifted into the revised mode in an expeditious manner.

A. Project Monitoring and Evaluation

One of the major findings of the evaluation was that data collection in the project had been inadequate to date. The need for data has not been misunderstood, but rather project personnel charged with responsibility for both project implementation and data collection have given priority to the former. This amendment separates to some degree the two responsibilities and the personnel who are to achieve them.

The object of project monitoring and evaluation will be twofold:

1. To assess the net effect of project interventions to determine the economic viability and potential for continuation in the same area, or replication elsewhere.
2. To use the information obtained to concurrently regulate animal numbers to range carrying capacity and water supply.

With this in mind, data will be collected in four major areas:

- a. Range Resources
- b. Livestock Productivity
- c. Household Animal Protein Consumption
- d. Household income

1. Range Resources

a. Range Carrying Capacity

The most challenging question for this project is to establish the effective carrying capacity of the range and then to regulate animal numbers to range capacity and water supply. Unfortunately herd size is very difficult to establish because the water and forage supply vary widely from year to year largely in relationship to rainfall of that season with some residual effect of the previous years. In the project area the water supply will be increased over a large, underutilized grazing area and our estimate is that cattle numbers will increase over the next six years to approximately 25,000 units (Tropical Bovine Unit, UBT).

There is a natural tendency for herders to see the underutilized range and water of the good years as a potential resource which they can take advantage of by increasing their own herd. This herd expansion also increases their danger of loss in the bad years. Traditionally, the adjustment of herd size downward has resulted from animal deaths with consequent loss of potential income to the herder. The prospects of a larger herd size leading to larger potential losses is a haunting feature of a new range management system.

The extension features two elements which will significantly reduce the prospects of crisis loss and facilitate the herders' management of herd size in a more optimal relationship to forage and water supply: Provision of information and better marketing.

A system to provide current information on range conditions will enable the herder to anticipate the seasonal carrying capacity well in advance of a crisis situation. With early warning, herders should not be forced into crisis sales or animal losses, but can reduce herd numbers at greater advantage to themselves. Information systems such as radio communications will also enable the herder to know the current market price for animals. The extension period (3 years) should be adequate to put the information system in place so that it can be carried on by GOS project personnel. Since the objective of the information system is behavioral change definitive results will probably need to be measured over a longer period of time.

The project will provide some assistance in organizing improved market outlets. The option of occasional major expansion of marketing without disastrous price falls will facilitate the herders response to anticipated poor range conditions. Selling animals earlier in better condition will also increase the farmers net return as well as leave his herd in better condition at the end of the stress period, and thus more readily able to capitalize on the subsequent improvement in range conditions. Thus, by increasing the herders access to range and price information and increasing his market outlets, the opportunity will exist to fully exploit the enhanced potential of the range without an increase in the risk of catastrophe. As a matter of policy, the GOS is committed to reducing public sector involvement in the economy in favor of a more vigorous private sector. In the Bakel area, the current limited supply of animals for sale as well as the herders lack of pricing information conspires to restrict price completion. Recently, however, a group of herders took the initiative and trekked their animals over 400 kilometers to the market of kaolack. There, they received more than three times the price they would have received if they had sold under normal conditions near villages. Current GOS policy is to try to assist herders to form cooperative for purchase of supplies and marketing which will enable them to rent transportation and sell their cattle wherever they choose. it is expected that organization and education of herders to exploit better price competition mechanisms will take four or five years. The project will provide a small revolving fund (\$50,000) which will permit the GOS to aid in promoting local price competitions until such time as free markets and natural competitive systems are in place.

This project will provide for the set up and operation of both the range condition and pricing information system and the supplementary market service. A crisis range condition is not expected in the life of this project so the system will not be fully tested. However, if these systems are to serve their intended purposes they must be fully operational and dependable by the time the range begins to reach its capacity. Consequently the establishment of these two management tools is a key to the eventual success in efficient range management.

b. Range Monitoring and Evaluation

As a field laboratory, the various elements of the project will be under frequent evaluation during this extension. The techniques of range performance monitoring have been simplified and designed in such a way as to minimize interference with herd management operations and thus distort the very factor that is to be measured.

The most important factor to be monitored will be range condition. A simple survey technique has been applied in the initial phase for regular measurement of burn areas and for estimating available forage for dry season use. This technique will be refined to track seasonal changes in available feed supply on the range. The project will attempt to establish a regular recording system which is meaningful to the herders and assists them in maintaining their records. The long-term expectation is that as the herders develop a systematic understanding of the relationship between range conditions and cattle numbers, they will develop processes of regulating herd size to achieve maximum return. The crucial task is to successfully establish a technique of measuring and recording range conditions that provides the herders with a reasonable indication of carrying capacity. During the course of the project the herders will become involved in the information gathering phase while the staff will continue the information dissemination as a modest task associated with delivery of health services.

The project will establish a simple system for reporting range condition for each season of the year,, that is, first immediately after the rains and then at 90 day intervals from that time. Four standard range conditions for each season of the cycle will be reported: excellent, good, fair and poor. (The scale can be redefined if feasible at a later stage by adding either one incremental step such as very good or multiple increments such as good plus and good minus). Pictures of demonstration plots of range conditions for each season will be widely published to ensure that herders and project staff have a similar understanding of range conditions. The data will be collected from a pattern of random sampling observations which will provide a complete picture of the range conditions in major sections of the range. The information will be quickly collected, compiled and reported to all herders in the project area.

At the same time the water conditions in the ponds will also be reported. This information is less subjective, more easily collected, probably more critical and will be available on a monthly basis. The project staff will also collect rainfall data at each pond site as an indication of comparative water shed productivities.

From vaccination records and cattle counts at the various ponds the project staff can provide regular reports suggesting how conditions might change in the subsequent period. With this information, (range condition, pond condition, and cattle population) the individual herders can make better decisions about locations for good grazing in subsequent months and the urgency of selling mature stock. Throughout the extension, the utility of this data as well as the techniques of collection and reporting will be refined in order to improve the utility in herd management.

A limited number of herds will be selected for comprehensive study of growth and health characteristics. Efforts will be made to select herds from the full range, a crucial factor being the cooperative attitude of the herder. A simple record of numbers, general body condition and health condition will be maintained at monthly intervals. This individual herd data will be compared with monthly pond surveys, conducted for a 24 hour period at each pond.

The project period is not expected to include a stress situation as cattle numbers will be well below the carrying capacity of the expanded range. However the baseline of good grazing conditions needs to be established and systems of monitoring fully operational before the stress periods occur. The herders must develop their understanding of this new information and be given some time to learn how to use it. The project period provides the time for getting this system effectively operating, and may allow one or two years for additional refinement before a range stress may occur.

The data generated by the range monitoring system will provide the detailed information for evaluating the effectiveness of the ponds and more extensive range use, may provide new understanding of range use in connection with surface ponds, and will provide data for evaluating project operations. These indirect uses of the monitoring system are perhaps more valuable outside the project and will involve some data and analysis procedures supplementary to the monitoring procedure. However, evaluative procedures are to be designed to be as passive as possible so that the process of evaluation does not interfere in the herders perception and use of the new range features.

Ultimately, it is the herders perception of this resource that must be measured by his attitudes and use of the range. Unfortunately, customs and social patterns make it extremely difficult to collect precise information on individual herds. Consequently, sample and census data will be relied upon very heavily in the evaluation of project impacts on the beneficiaries.

The range monitoring and evaluation activities will be the responsibility of the long-term range manager and his GOS counterpart. It is estimated that this activity will require 40% of their time.

2. Livestock Productivity

Livestock productivity will be most reliably and validly assessed through an estimation of the net reproduction rate of females, that is, the herd's maximum real potential rate of growth in the long run and mortality rates for marketable animals. The information required to assess these vital rates will consist of age-specific mortality and fertility rates for females and age-specific mortality rates for males. These data will be collected by following the life histories of three sample herds which include cattle of all relevant sexes and ages. These herds were selected and ear-tagged in 1980.

The second aspect of herd productivity will measure milk yields. A sample of lactating cows will be selected and their milk output estimated throughout the year. The sample will have to be simply stratified to compare the milk output of project cattle involved in the dry season family milk program with those that are not (e.g. by simple analysis of variance).

The livestock productivity monitoring activity will be the responsibility of the four person GOS technical staff. It is estimated that this activity will require 15% of their time.

3. Household Animal Protein Consumption

To monitor household animal protein and other food consumption, basic techniques of nutrition surveys will be used, limited to reliable measures of food intake. Even with this limitation, this will not be easy. Typically, food intake data are obtained both through interviews and meal preparation observations. To keep the survey to a manageable level, food intake data collection should be concentrated on meat, milk, and basic staples, in this case, locally grown cereals and purchased or donated grain.

Meat intake data may be obtained by observation with additional reliance on questions about frequency of consumption of small ruminants and poultry by households.

Milk intake will be observed and measured. This will be done by measuring the quantity of milk taken from cows in the early morning and evening.

The quantity of other foods consumed will have to be considered for statistical verification of the evolution of meat and milk consumption while "holding everything else constant." Grain consumption will be taken as a proxy for "all other foods." The most practical way to measure this will be to weigh the quantity of grain to be cooked for each selected sample household.

This kind of work will necessarily have to be carried out year-round, on a continuing basis. Furthermore, the food consumption household sample will have to be stratified according to a few indicators (size of herd owned by the household, estimated income), to see how these factors influence food consumption over time.

The monitoring of household animal protein consumption and income will be the responsibility of the long-term graduate student and enumerators. It is assumed they will devote 100% of their time to this activity.

4. Household Income

To proceed with this stratification, and also determine project-related benefits over time, information on a few "purely economic" indicators should be collected. These should cover basic data on household budgets, income, income in kind and cash including remittances from abroad, and like expenditures. Information on cattle, meat, milk and grain prices will be needed, as well as the extent of livestock marketing. The extent of in-and out-migration will also have to be established and followed over time. Finally, the redistribution effects which will apply to benefits generated by project activities will have to be estimated. This can be estimated by studying prevailing local inheritance practices, and monitoring the evolution of incomes between the various social strata (castes).

It must be emphasized again that this monitoring effort will have to be undertaken on a continuing basis as soon as possible and over the life of the project. This is of cardinal importance for two reasons:

a. Since no "control group" is readily available, continued monitoring will provide the means for the evaluation of net benefits received at the conclusion of project activities.

b. This very process to benefit assessment will be made more reliable and valid; ongoing monitoring will help sort out benefits due to project interventions from benefits due to various possible competing explanations. In the case of the project at hand, competing explanations can be summarized into four categories:

- (1) Underlying long-term trends.
- (2) Short-term fluctuations.
- (3) Exogenous effects; and
- (4) Stochastic (random) changes within the target group.

Continuing monitoring is the only method through which one can hope to separate effects due to project interventions from what would have happened "normally" without project activities, and from effects whose root lies neither in project activities nor in the normal chain of events without project activities. Continuing monitoring efforts will therefore help in the final evaluation of the project and provide useful feedback information to project staff.

B. Range Development

Livestock grazing is the principal use of the 150,000 hectares which comprise the expanded and redefined Project Zone. Within this zone, the majority of livestock are owned by sedentary, agro-pastoralist villages, living adjacent to the range. In general, the livestock are herded in habitual use areas near villages, except for certain periods during the farming calendar when it is desirable to have the animals away from crop areas. At such times herders graze the livestock at out-camp areas where there is a natural but often temporary water source. As the water source dries up, the livestock return to grazing areas near villages where there is a water supply.

There are some transhumance cattle that graze within the Project Zone when temporary water is present, though this is not a well established practice.

The objective is to establish a relatively simple range improvement program that will ultimately allow for the implementation of a grazing system that will enhance the livestock production opportunity for the tenured village herders within the zone.

1. Water Development

Grazing use away from the villages within the zone continues to be limited by the absence of reliable (seasonal and permanent) water. To date, the construction and subsequent use of seven ponds has expanded the use-zone of the herder groups and extended the livestock grazing period away from village areas. This combination has relieved grazing pressure around village areas, but the number of ponds remains inadequate to gain an assessment of impact on the whole range. It should be noted that, while the Project Agreement was signed in 1974, effective implementation began in 1977. The heavy equipment

needed to work on the ponds was ordered in 1977 and has been in use only during the dry seasons of 1978-79 and 1979-80. (Since this amendment was submitted, the 1980-81 dry season has come and gone. During the period 2 more ponds were constructed and 2 others cleaned).

Three new hand-dug, cemented wells have been constructed and several others deepened, but permanent water for both human and livestock populations remains inadequate.

This amendment will complete adequate water development through:

a. The judicious location and construction of additional ponds (approximately 10).

- The ponds are dug ponds with no linings or sealants and no fencing or associated structures. Therefore, the total construction cost of a pond can be broken down into equipment operations and amortization plus overhead. Equipment operations to date have cost 22.30 dollars per hour times 300 hours per pond or \$6,700 per pond. Amortization per pond at a delivered bulldozer price of \$90,000 and an estimated operating life of 6,000 hours would be \$4,500 for a total direct cost per pond \$11,200. With the addition of 16 percent overhead, the cost per pond is \$13,000. Given increasing costs and especially, the increasing age of the equipment, it is anticipated that operating costs for replication would increase substantially, perhaps to as much as \$35 per engine hour of operation.
- The project engineer indicated in his design that ponds would need to be cleaned once every three years. Field observations indicate that cleaning will have to be done every 3 to 4 years depending on the pond. This involves cleaning out accumulated sediment with a bull dozer. This is estimated at 50 machine hours or one sixth the cost of construction, that is to say \$2,200 every 3 to 4 years. If an average of five ponds are cleaned yearly, annual cost would be \$11,000. There are no other operating costs associated with the ponds, since the herders use them just like natural water sources. With maintenance done as indicated above, the ponds should have a life conservatively estimated at 25-30 years.

b. The improvement of some existent village water supplies (repair and deepening of some wells), and the potential development of new wells to stabilize a clean water supply for village and livestock use.

The additional water supplies will expand the area for livestock use and help to stabilize a grazing pattern between the traditional village range areas and the newly available forage areas near developed water.

The final water point development sites will depend upon the range/hydrology survey information that will be developed early in the implementation phase. Site priorities will be established with final selection awaiting consultation with village herder groups in order to prioritize their inputs. The ultimate decision will be based on a consensus opinion which considers all of the variables leading to viability of the range management plan.

2. Fire Control

Access Roads* (Fire Breaks) will be constructed as new water points are developed. Key roads, used for equipment and community access to ponds, will be maintained as equipment, operations and maintenance funds are available. An estimated additional 62 Km of access roads will be constructed.

Fire prevention and fire control efforts will be continued by access roads, whose secondary purpose will be as fire breaks.

Roads and Firebreaks

- Firebreak/access road construction to date is estimated at \$1,050 per Km for new construction and 525 /Km for improvement. These costs are so low because the terrain is table-flat, there are no structures, and road standard is "Piste" or trail. Future new road construction costs are expected to rise with pond costs to about \$1,500/Km.

Maintenance is done once yearly just after the rainy season and involves removing the vegetation with a grader. This is estimated at \$100 per Km at present, headed for \$150/Km in the future. They are usable as roads throughout the dry season but only intermitantly in the rainy season.

The road along the project boundry from Mbaniou to Bakel is heavily used in the dry season by heavy trucks and light vehicles as a short cut between Tambacounda and Bakel. The firebreak access roads within the zone are lightly used by project vehicles, light vehicles for local commerce, and inter village traffic. There was no access anywhere into the zone prior to the project except by donkey cart paths or livestock trails.

- The 62 additional Kms of access road projected for the PP amendment constitute a road paralleling the escarpment along which there is a series of 13 villages, presently connected only by a donkey cart trail. These villagers are the beneficiaries of the entire Santhiou Fisa Zone as described in section III.F. of the PP amendment. Easy access to the beneficiaries and to the additional pond and vaccination park sites is required.
- Best road and best firebreak alignments do not always coincide, but the routes always serve to some degree both functions. Of the existing routes, about 70% were selected for optimum fire control 30% primarily for access. The new opening of 62Km will serve primarily for access but will prevent fires originating in or near the villages (the most likely places of origin) from spreading westward into the range lands.

*Access roads are simple, brush-free rights of way with some road crown and side drainage. There are no culverts, cuts or fills and construction is carried out by a bulldozer and grader.

Concerning firebreak maintenance, eaux et forets, in cooperation with public works, has responsibility for maintaining about 4,500 Km of firebreaks in northern Senegal. This responsibility has been carried out yearly for at least 15-20 years. These same administrative responsibilities and resources could be applied to the Bakel project site and could include pond maintenance. A second possible evolution could be that the project would fall in the future under the authority of an Integrated Regional Development Agency. In this case, the interest of the development agency in maintaining project infrastructure would tend to be tied to commercial production in the zone. This decision will be made before the project amendment period is completed.

3. The Grazing System

As range improvements are put in place, and "tenured" grazing areas are assigned village herders, the "assigned users" will assume responsibility for restricting encroachment by outside herders into their defined grazing areas.

Assignment of areas will be influenced by village proximity to water points and forage areas. Village herder groups will provide input for the formal designation of range use areas.

As planned range improvement interventions (water development and access roads) are developed, and as monitoring data is collected and evaluated there will be the incremental development of a functional grazing system that will incorporate degrees of rest and rotation.

The grazing system will be simple and functional, premised on water availability and control. Key water point development will make existing forage available to livestock. In the past, much of the project area produced an abundance of forage that was basically unavailable because of the lack of water.

Current forage utilization within the Project Zone is well below its potential carrying capacity. Collateral data from similar vegetative zones and limited data from project sites would indicate an annual carrying capacity of approximately 25,000 UBT's (Tropical Bovine Unit) for an area of approximately 150,000 hectares; or 6 hectares per UBT per year.

C. Livestock Production Activities

The original CID design work included a rather detailed discussion of livestock activities, but the PP itself failed to discuss the specific activities to be undertaken. The result has been that GOS livestock personnel are presently promoting a number of livestock practices as if each had equal value and equal chances of being adopted.

The project will focus on a limited number of practices that are of proven value (animal health), are scientifically sound (salt mineral supplementation, primarily phosphorus), or that can be expected to show immediate results of high value to the herder (increased milk availability to the family in the dry season).

These are the three practices that will be aggressively implemented. Other practices (branding, dehorning, castrating, etc..) will be retained as "soft sell" extension education themes only.

1. Animal Health Program - The PP amendment includes continued delivery of the preventative animal health package, primarily a group of vaccinations as described in the original PP, administered with the cooperation of the Service d'Elevage. Livestock agents will also have a limited stock of veterinary drugs for treatment of sick animals: worming medicines, sulfa drugs for simple infections, etc. The objective is to furnish minimal veterinary services to herds on an "as requested" basis as project personnel move about the zone, rather than to establish permanent veterinary clinics.

Five permanent vaccination parks have been constructed and are adequate for the existing zone. An additional 3 parks will be constructed in the expanded area.

The value of vaccinations and veterinary treatment is generally well recognized by herders throughout west Africa including those of the zone.

Certain treatments including vaccinations for rinderpest, BPP, Blackleg, Internal Parasite Treatment for young stock, and treatment for ticks are provided at cost and upon request. The 1980-81 level of treatment extrapolated to 23,000 head totals \$31,500 annually for medicines.

Of total veterinary medicine costs about \$11,500 is provided free and \$20,000 at cost. The GOS is exploring encouraging private sector provision of services. Currently, delivery of veterinary services is a year long activity covered by project overhead (16% of total project costs to date). The veterinary medicine product costs plus overhead gives an average cost of \$1.59 per head per year for veterinary coverage.

2. Supplemental Feeding

Widespread, routine supplementation with salt and minerals will be promoted. This is presently being done with imported salt and mineral blocks, but the project will introduce a salt and mineral mixture based on sea salt produced in Senegalese estuaries through traditional methods and bone meal available through the slaughterhouse in Dakar. This will reduce considerably the cost per kilogram of salt and mineral supplements.

Hay making is not generally practiced in the zone. It will be promoted as part of the package for the family milk program as discussed in item 3 of this section.

Additional supplemental feeds (agro-industrial by-products such as oil seed meals) will also be limited in use to the family milk program.

Purchased inputs will be minimized and limited to salt, minerals and protein supplementation at 1Kg/head/day. The bulk of the supplemental rations will be grass hay, cut by hand. The cost per cow for a 120 period is estimated as follows:

- Hay - 900 Kg., estimated four person days family labor at 82.5 (250 CFA/\$)
: \$3.30
- Salt and minerals (50/50 mixture) - 6Kg. X (40 CFA/Kg.): \$0.80
- Peanut Cake: 120 days X 1 Kg. X 13.3 = \$16.00
- Veterinary coverage, estimate \$2.00
- Total of purchased inputs per head \$18.80
- Grand Total \$22.10

On strictly economic basis the benefit can be calculated as:

0.5 liter milk increase/day X 200 CFA/liter X 120 days = 12,000 CFA or \$40 for an IRR of almost 100%. In the realm of human welfare, the value of milk in the late dry season to a herder family with young children, pregnant women, dried up cattle, little money and limited access to a store might well exceed the dollars and cents economic value. The technical feasibility of the type of feeding has already been demonstrated in a trial program during the 1980-81 dry season, which produced results as cited above based upon the cited feeding plus the greater access to village water resulting from other livestock being drawn away to the ponds.

There is no obstacle to private sector involvement in the feeding program if they can provide needed goods and services and, in fact, it is expected and desired that the private sector go into supplementary feeding once a satisfactory level of demand and results has been demonstrated over time under the project.

3. The Family Milk Program

This constitutes one of the most interesting and promising elements of the project. It was initiated on an experimental basis in 1980 by the project staff and deserves to be encouraged further.

The family milk program is somewhat comparable to "embouche paysanne," but involves feeding for milk production rather than monetary income from steer sales. The late dry season, from March through May, is a particularly trying time in the project area for both man and animals. Water and food are scarce, and milk is particularly in scarce supply. Cows calving during the late dry season are frequently in such a poor state of nutrition that milk flow, either to be used by the family or for survival of the calf, does not develop. This problem is reflected in the price of milk which varies from 70 CFA per liter in the rainy season to 300 CFA in the late dry season. Milk is the primary source of animal protein for the family, and its absence is a particular hardship for children and expecting or lactating mothers. The approach recommended is that as many households as possible in the project area be given the means and inducement to select two lactating cows from the herd which are then given supplemental feeds and minerals. These cows together with their calves, should be kept as close as possible to a selected household, and be particularly well cared for. This would allow the family, and specifically its neediest members, to enjoy a more balanced diet in the late dry season. Success of this activity should have a significant effect on human health and infant mortality.

The activity is programmed in two phases. Hay making, by hand, in late September will be introduced. (The present small amounts of hay cut for horses, is really straw harvested after maturity). Two milk cows will require about 900 kg of hay for a three month period. (

This

activity falls during a period of a relatively light farm work load since all crop weeding has been completed but harvesting is still about 45 days away.

Beginning in March, milk cows will be selected and kept close to the compound. They will be given salt and mineral supplements, 6 to 7 kg of hay per animal per day, and one Kg/per day of oil seed (peanut) cake. This is not a ration for high milk production, but the production capacity of the native cow is low, and it will allow her to produce near her capacity of 2 liters per day.

D. Marketing

The project will intervene directly in livestock marketing in the project zone on a discrete basis at times when area herders are in a particularly weak negotiating position but will not compete with or replace the existing marketing system. These periods of market activity will include livestock purchases during the rainy season (commonly referred to as the "hungry" season because cereal crops have already been planted while the prior year's crop is frequently exhausted), other periods when human food supplies may be inadequate, and in the early dry season in order to encourage marketing of slaughter age males prior to the severe weight losses normally sustained in the late dry season.

The project will purchase directly from herders at a fair market price, per kilogram, live weight. Only animals which can be immediately resold, in urban centers such as Dakar, through standard arrangements, will be purchased: slaughter age males and culled cows of 230 or more kilograms. Project management will be responsible for road transportation to and resale of these animals. These periodic market interventions, if anything, should stimulate competition among already existing buyers/brokers who traditionally take advantage of the "hungry" season to offer herders below market rates.

The revolving fund established for this purpose (presently \$25,000 with \$100,000 scheduled for this amendment) will permit project participation in marketing of an estimated 20% of total yearly off-take, more than sufficient to cover estimates for required market interventions during the aforementioned periods over the life of project. Projected revenues and expenses will be calculated so that the revolving fund is not decapitalized.

E. Project Organization Administration and Evaluation

Since inception, the project has been plagued by the problem of the division of administrative and financing responsibilities between two separate Ministries. The technical aspects have been the responsibility of the Project Director under the Department of Health and Animal Production (DSPA). Extension and education (including technical subject matter oriented to both male and female audiences, functional literacy) have had separate financing and fall under the Secrétariat à la Promotion Humaine, in effect, a Ministry of Social Welfare. These combined extension/education, literacy, village organization and home economics activities are referred to as "Promotion Humaine". In addition to the administrative problem, it has led to a plethora of GOS personnel assigned to the project, in numbers far beyond what is really needed. The evaluation findings, reconfirmed during this amendment design, indicated that the inclusion of "Promotion Humaine" in the project had not led to effective communications with the villagers. On the contrary, it was felt that the "PH" activities have hindered technical livestock personnel from establishing effective two way communications with the population in the project zone.

For the period covered by this amendment, the project will be structured as follows:

1. The Department of Health and Animal Production will be responsible for administrative and financial management of the project. All personnel assigned to the project will receive their support through the project director named by that GOS agency.

Funds handled by the GOS include those for recurrent costs, heavy equipment operations, and the revolving fund. Advances for an estimated 90 days of operations are made to the project. These funds are deposited to a bank account authorized by the GOS Ministry of Finance. Justifications of advances are made on quarterly basis to USAID according to budget line items specified in letters of implementation. Separate accounting is maintained for the recurrent costs and the revolving fund. Justification of advances is received in summary form by USAID. The project retains on file all original receipts. Financial operations and reporting to date have been without major problems and no future irregularities are anticipated.

2. The "Service of Eaux et Forêts" is not strongly represented in the zone and has not played an active role in fire control as projected in the original PP. Therefore, the project management will maintain, on a yearly basis, all access roads and firebreaks. Eaux et Forêts will have responsibility to assist project personnel in extension/education and organization of villagers for fire control, in an advisory capacity.

3. The project will assume responsibility for construction of wells and ponds in the project area. The "Service de l'Energie et de l'Hydraulique" will provide technical supervision and quality control of the work.

4. The role of Promotion Humaine will be altered and limited. Its initial task of collecting socio-economic data, demographic information and making initial contact with the population is no longer valid at this stage of the project.

5. In implementing this amendment, the project managers will place priority upon securing technical assistance, implementing the recommendations contained in the annexed environmental assessment and elaboration and implementation of a sound marketing/off-take strategy which is capable of continuing following project completion.

The services to be provided by Promotion Humaine under this extension will include extension education and adult literacy. Two agents from the "Direction de Formation Professionnelle et Rurale," technically qualified in the agricultural sciences, will be assigned to the project. They will share with DSPA personnel the responsibility for extension/education and implementation of livestock and range activities. Their duties will include responsibility to assist the administration in organizing and orienting the leadership of the "Groupement des Communautés Rurales", which under the administrative reform of June 1936, are to be given authority over land use within selected project areas (including Senegal Range and Livestock).

The other service to be provided by Promotion Humaine agents is adult literacy. Six adult literacy classrooms (traditional huts built larger and with more permanent materials) have been constructed by the GOS within the present project zone. The project will support this activity by providing teaching materials and aids, two wheel vehicle transport for instructors, and travel funds for quarterly supervision by central offices in Dakar. The GOS will pay all base salaries.

As noted in item III A I. above, all Promotion Humaine personnel working in the project will receive support through the Project Director.

The project has benefited enormously to date from evaluation activity. During the amendment period it is expected that a significant evaluation component would be exercised. Specifically two routine annual evaluations would be conducted at the conclusion of months 12 and 24. A final evaluation would take place at the conclusion of month 36. For purpose of evaluation, the indicators contained in the logical framework (Annex A of this amendment) represent accomplishments for the amendment period only. Future comprehensive evaluations of the entire project would draw their targets from the addition of amendment period indicators and actual project achievements as stated in the 1980 evaluation. For example, the total number of ponds to be built during the amendment period (see logical framework) and 7 built before 1980 evaluation (see evaluation report).

Funding to carry out these evaluations has been provided in the budget under the technical assistance item.

F. Project Boundary Modification

The two zones of the original project were:

1. The Toulekeddi Zone: Bounded by the departmental boundary to the west, the limits of the IBRD-financed livestock project zone to the south and a natural boundary escarpment, to the north and the east.

2. The sarré Zone: to the east of the escarpment, up to the Bakel Kidira Road, considered to be western limit of SAED's river-based development interventions.

Intervening project implementation and research experience demonstrated that:

a. Far from marking a range use boundary, the escarpment itself lay at the center of a particular land-use system that depended upon the diversity of micro-ecological options provided to it by both sides of the escarpment.

b. Much of the Toulekeddi plateau range (west of the escarpment) was systematically and customarily used by the dense cluster of villages and hamlets situated along the escarpment, even though half of these were in a different zone (Sarré), and half fell outside of the project perimeters altogether.

c. There is more plateau range (for which the pond construction approach has proved suitable) to the south of the Toulekeddi zone that has not been included in the IBRD-financed range development plans. As this plateau descends into an escarpment, to the east there is another cluster of villages (geographically and sociologically situated so as to utilize the plateau more intensively once water sources are developed on it) as yet unattended by any rural development project.

These villages form a livestock cooperative with those villages running north along the escarpment, presently situated in the western portion of the old Sarré zone.

d. The existing Toulekeddi and Sarré zones are inappropriate from a land-use sociology point of view.

For these reasons, project management has proposed the following three sub-zones for the new project:

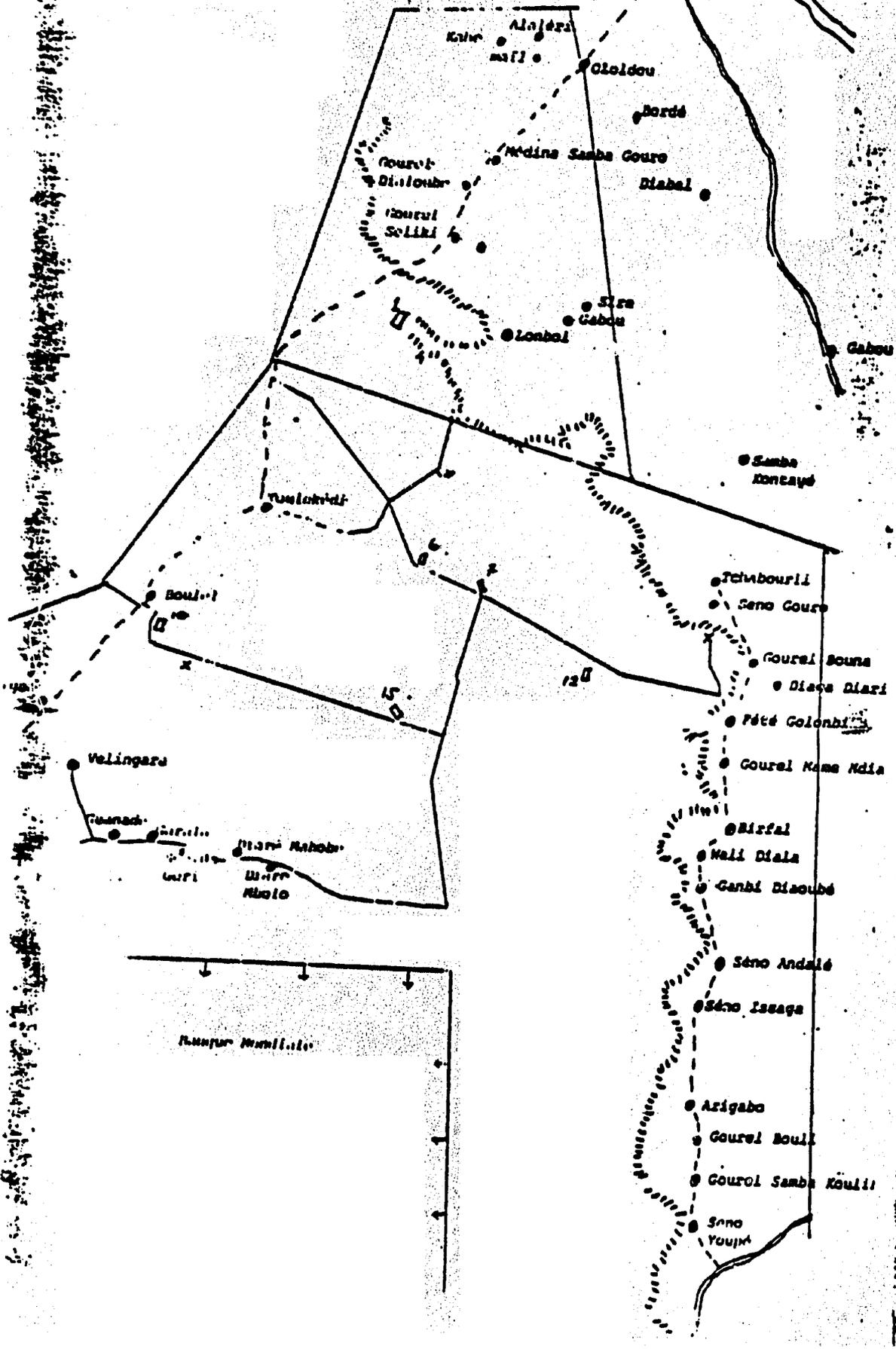
1. The MBaniou zone: comprising all the villages of the former Toulekedé zone (plus the Sawol area, adjacent to the west and excluded from the IBRD-financed effort) and the range to be used once pond construction has been completed. This would only extend to the middle fire break of the former Toulekedé zone, leaving the plateau range to the east to be reattached to the villages that use it: those villages off the escarpment to the west of the former Sarré zone.

2. The Sanithiou Fisa zone: comprising the length of the escarpment from the Ololdou/Goudiry arrondissement boundary, on the north, to the railway line in the south. The line of villages along this escarpment (the northern half of which arbitrarily fell into the former Sarré zone) form a livestock cooperative based at Sanithiou Fisa, the southern-most village, on the railway. All of the villages in these first two new zones fall into the arrondissement of Goudiry Department of Bakel.

3. The Ololdou zone: comprising the villages and plateau range to the north of Ololdou/Goudiry arrondissement boundary, between the Matam/Bakel department line to the east to approximately the longitude of the central firebreak access road of the former Toulekedé zone. This area includes the 21 hamlets lying between the chef lieu d'arrondissement Ololdou itself, and the administrative boundaries on the south and west. This area thus also includes a portion of the plateau range in the former Toulekedé range. This portion and its pond, the first built, has been used almost exclusively by these 21 hamlets.

A map of these three, new sub-zones is shown on the following page.

After Dickie



G. Covenants

The following covenant will be amended to the Project Agreement:

The GOS agrees to submit within one year of the signing of the ProAg amendment a detailed set of criteria by which it will determine if activities undertaken by this project are, indeed, replicable in other parts of Senegal. Estimates of recurrent and implementation costs associated with any attempt to replicate project activities will also be included. Finally, the GOS will inform USAID of the factors influencing its deliberations on the issue of replication.

685-0202

SENEGAL

RANGE + LIVESTOCK DEVELOPMENT

Project Paper

Amendment No. 8

Annexes

Part II of II

FY 82

PROJECT DESIGN SUMMARYLOGICAL FRAMEWORK

Life of Project:
 From FY 74 to FY 85
 Total US Funding: \$4725
 Date prepared: 2/23/81

PAGE 1

Project Title & Number : SENEGAL RANGE AND LIVESTOCK DEVELOPMENT PROJECT (685-0202)

Objectives and Targets for amendment period only

| Narrative Summary | Objectively Verifiable Indicators | Means of Verification | Important Assumptions |
|---|---|---|--|
| Program or Sector Goal: The broader objective to which this project contributes: | Measures of Goal Achievement | | Assumptions for Achieving goal targets: |
| Productive capacity of the Senegalese national livestock sector increased and stabilized. | 1) Increased availability of animal products in both urban and rural areas. 2) Improved range productivity and stability by expansion of forage use areas and better livestock distribution relative to range carrying capacity. | 1) National Statistics: a. Slaughter records (sales, urban food). b. Rural consumption and Household budget surveys. 2) Trained Observation: a. An increase in the ratio of desirable, perennial grasses. b. An improvement in the composition of the forage species. c. An increase in the utilisation of forage that has previously been unavailable. | 1) GOS will encourage livestock production through price incentive. 2) GOS will continue to financially support the livestock service. 3) Overall satisfactory climatic conditions, relative to the Sahelian norm. |

PROJECT DESIGN SUMMARYLOGICAL FRAMEWORK

Life of Project:
 From FY 74 To FY 85
 Total US Funding \$4725
 Date Prepared: 2/23/81

Project Title & Number: SENEGAL RANGE AND LIVESTOCK DEVELOPMENT PROJECT AMENDMENT (685-0202)

PAGE 2

| Narrative Summary | Objectively Verifiable Indicators | Means of Verification | Important Assumptions |
|--|--|---------------------------------------|--|
| <p>Project Purpose: Effective, potentially replicable livestock production project implemented in the Bakel project area.</p> | <p>Conditions that will indicate purpose has been achieved: End of project status:</p> <p>1) a. Off-take increased from 10% to 14% per annum; herd growth increased from 3.9% to 5.5% after which herd population stabilized by increase in off-take</p> <p>b. Milk production increased by 15% in dry season.</p> <p>c. Calf, lamb and Kid mortality reduced by 30% from 9.6% to 6.7%.</p> <p>d. Total livestock mortality rate decline of 40% from 14.7% to 8.8%.</p> <p>e. Livestock fertility rate increased by 10% from 55% to 65%.</p> | <p>1) Project Monitoring Records.</p> | <p>Assumptions for achieving purpose:</p> <p>No natural disasters.</p> <p>GOS supports local range tenure discretion as outlined in "Communauté Rurale" reforme legislation.</p> <p>Levels of out-migration and foreign salary remittance do not radically change.</p> <p>No GOS change in DSPA (Direction de la Santé et de la Production Animale) support.</p> |

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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

ANNEX A

Project Title & Number SENEGAL RANGE AND LIVESTOCK DEVELOPMENT PROJECT AMENDMENT (685-0202)

Life of Project ;
From FY 74 to FY 85
Total US Funding \$4679
Date Prepared : 2/23/81

PAGE 3

| NARRATIVE SUMMARY | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
|--|--|---------------------------------------|---|
| <p>Outputs:</p> <ol style="list-style-type: none"> 1. Range Management Plan 2. Water Development 3. Animal Health Program 4. Family Milk Program 5. Marketing 6. Data collection/Monitoring unit | <p>Magnitude of Outputs</p> <ol style="list-style-type: none"> 1. Increased utilization of available forage and year long grazing within the project area 2. 10 new stock ponds 5 new or improved wells 3. No outbreaks of bovine plural pneumonia, rinderpest or black-leg within the project area, and reduced death losses from other diseases. 4. 250 families per year giving supplemental feed to milk cows in the late dry season. 5. Project capable of rapidly, economically intervening/assist in livestock marketing during periods of stress. 6. Two of three years of data on range, livestock, economic and social impact. | <p>Project Reports and Evaluation</p> | <p>Assumptions for achieving Outputs:</p> <p>Investment in livestock production continues to be perceived as an attractive investment opportunity</p> |

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

ANNEX A

Project Title & Number SENEGAL RANGE AND LIVESTOCK DEVELOPMENT PROJECT AMENDMENT (685-0202)

Life of Project :
From FY 74 to FY 85
Total US Funding \$4725
Date Prepared : 2/23/81

PAGE 4

| NARRATIVE SUMMARY | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS | | | | | | |
|---|---|-----------------------|-----------------------|-----|---------|--|-------|--|--|
| <p>Inputs :</p> <ul style="list-style-type: none"> 1) Commodities 2) Training 3) GDS Project Support personnel 4) Technical Assistance: <ul style="list-style-type: none"> Management and monitoring 5) Construction 6) Evaluation Component 7) Marketing Fund 8) Recurrent Costs | <p>Implementation Target (Type and Quantity) :</p> <p><u>See Financial Plan</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 50%;">US</td> <td style="text-align: center; width: 10%;">(in \$000's)</td> <td style="text-align: center; width: 40%;">GDS</td> </tr> <tr> <td style="text-align: center;">\$1,600</td> <td></td> <td style="text-align: center;">\$490</td> </tr> </table> | US | (in \$000's) | GDS | \$1,600 | | \$490 | <p>Purchase records Bills of lading Contractor invoicing Payroll records</p> | <p>Assumptions providing inputs</p> <p>Budgets, government approvals, deliveries of commodities and staffing of positions are timely and maintained.</p> |
| US | (in \$000's) | GDS | | | | | | | |
| \$1,600 | | \$490 | | | | | | | |

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PROJECT TRACKING CHART

ANNEX B

PROJECT NAME : SENEGAL RANGE AND LIVESTOCK DEVELOPMENT PROJECT AMENDMENT

PROJECT NUMBER: (685-0202)

DATE: 12/17/80

| COMPONENT | PLANNED TIME FRAME BY-MONTH | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|--|--|--|--|
| | 3 | 2 | 1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | | | | | | | |
| 1. PACD on existing project extended | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. PIO/T for technical services prepared for: Range/Hydrology study, Monitoring team and Water Development/heavy Equipment Supervision | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. PIO/C's prepared for all equipment | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. Initial locations identification for new ponds | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. Initial pond locations discussed with village authorities | | | | x | x | x | x | x | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. Project Grant Agreement Amendment Signed | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. PIO/C's and T's submitted | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8. Bids prepared for T/A by SER/CH | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. Equipment & vehicles arrive | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10. Annual project work plan submitted | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11. Pond, access road, dug well construction continues | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12. Pre-Amendment data collection continues | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | 3 | 2 | 1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| :13. T/A Team Members arrive | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :14. Senior supervisor of team arrives | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :15. Water Development/ Heavy Equipment Supervisor arrives | | | | | | | | | x | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :16. Monthly data submitted | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :17. Animal health delivery services continue | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :18. Range & Herd Data analyzed for benchmark progress | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :19. Construction progress | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :20. Routine Annual Evaluation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :21. Long Term participants chosen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :22. Long Term participants depart | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :23. Short Term participant training begins (intermittent as desired) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :24. Annual project work plan analyzed and approved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :25. Family milk production program | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :26. Major evaluation with replication & follow-on | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :27. Final Monitoring Team report prepared | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| :28. Final Evaluation takes places (USAID/GOS staff) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Procurement Plan

Procurement for this project will be the responsibility of the Livestock Office of USAID/Dakar. Commodities listed on the financial plan will be further defined with detailed specifications prior to January 31, 1981 by the foregoing office and PIO/Cs will be prepared according to those specifications and cost estimates. It is anticipated that the Afro-American Purchasing Center (AAPC) will be designated by the GOS as procurement agent for this project. Aside from POL Purchases and other small line items to be procured within Senegal, the authorized source for procurement under this project amendment is the United States.

Contracting will be direct AID secured. The positions needed for the range/hydrology feasibility study, range management, socio-economic indicators monitoring and senior supervision will be contracted with a United States University having a strong arid lands, range management capability. The position of Water Development/heavy equipment supervisor will be filled through a USAID-generated PSC, with the assistance of REDSO/WA contracting officer. As with project commodities, PIO/T's will be prepared by the USAID Livestock office. Recruiting for the PSC position will be the responsibility of USAID/Dakar with assistance from AID/W or REDSO/WA, as required. Approximately one year after project obligation, USAID will initiate a PIO/T for an evaluation team which will be contracted by AID/W through an IOC arrangement.

December 19, 1980

ANNEX D

SENEGAL RANGE AND LIVESTOCK DEVELOPMENT PROJECT AMENDMENT

(685-0202)

PROJECT FINANCIAL PLAN

| <u>Project Inputs</u> | <u>(\$000's) AID Grant</u> | <u>Amount for a fully funded project Government of Senegal (1)</u> | <u>Total</u> |
|---|--------------------------------|--|--------------|
| <u>A. Commodities</u> | | | |
| 1) Vehicles, (3) 4 x 4 | \$ 42 | - | \$ 42 |
| 2) Veterinary supplies, vaccins mineral salts | 23 | 54 | 77 |
| 3) Miscellaneous, -equipment and supplies (adult literacy) | 42 | - | 42 |
| | <u>107</u> | <u>54</u> | <u>161</u> |

(1) US \$ = 210 Frs CFA

ANNEX D (Continuation)**B. Training**

| | | | |
|---|--------------|---|--------------|
| 1) 5 person years at Master's level | 120 | - | 120 |
| 2) 12 person months interafrican training | 24 | - | 24 |
| 3) Adult literacy and local training | 15 | - | 15 |
| | <u>\$159</u> | | <u>\$159</u> |

C. Construction

| | | | |
|--|---------------|------------|---------------|
| 1) Local contractant or GOS force account for new or improved dug wells | \$ 50 | \$200 | \$250 |
| 2) Vaccination parks, 3 | 36 | - | 36 |
| 3) Heavy equipment operations | | | |
| a. pond construction | 105 | - | 208.75 |
| b. access roads | 29.8 | | |
| c. pond maintenance | 18.95 | | |
| d. access road maintenance | 21 | | |
| e. erosion control | 34 | | |
| 4) Local labor for construction | - | 111 | 111 |
| | <u>294.75</u> | <u>311</u> | <u>605.75</u> |

D. Technical Assistance

| | | | |
|--|------------|---|------------|
| 1) Range/Hydrology stud 3 person months | 40 | - | 40 |
| 2) Evaluation at 18 month, and final 3 person months | 45 | - | 45 |
| 3) Range Manager, 2 person years | 244 | - | 244 |
| 4) Water development advisor, 2 person years | 244 | - | 244 |
| 5) Graduate student for long term study of project economic benefits, 2 person years. | 70 | - | 70 |
| 6) Senior supervisor for item 5. 3 trips, 3 person months. | 42 | - | 42 |
| | <u>685</u> | | <u>685</u> |

ANNEX D (Continuation)

| | | | |
|--|---------------------|-----------------|----------------------|
| F. <u>Revolving Marketing Fund and Feeding supplies</u> | 58.6 | | 58.6 |
| II. <u>Recurrent Costs</u> | | | |
| 1) Vehicle operations and repair 8 light vehicles, 1 truck (30% of purchase price per year for two years) | 94 | | 94 |
| 2) Personnel GOS Civil servant salaries Indemnities and local travel | 75 | 61 - | 75 61 |
| 3) Other operational costs Office supplies, reports, maps, generator operations, building maintenance | 80 | - | 80 |
| G. <u>Contingency</u> | <u>249</u> 46.85 | <u>61</u> 64 | <u>310</u> 110.65 |
| Grand Total | <u>1,600</u> | <u>1490</u> | <u>12,090</u> |

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ANNEX E

Senegal Range and Livestock, Project N° 685-0202
Economic Analysis of the Project Extension

- I. Overview of the Senegalese Economy
- II. The Livestock Sub-sector
- III. Economic Analysis of the Project
 - A. Methodology and Assumptions
 - B. Summary of Assumptions
 - C. Tables

I. Overview of the Senegalese Economy:

The present state of the Senegalese economy is troublesome. The very poor agricultural situation, which is intimately tied to other sectors of the economy, resulted in the downward trends recorded in these sectors.

The last five crop years have been catastrophic and have had a tendency to put the economy in a long term recession.

In 1980, the index of industrial production, already well below its 1978 level, dropped an additional 13.5% in comparison to the last six months of 1979. In spite of a restrictive import policy, the trade deficit grew to FOB 96 billion F CFA at the end of 1980.

The state of public finances has not been left out of this gloomy picture: 12.7 billion CFA deficit for 1979-80.

In the agriculture sector, the debt situation at the farm level, with a very poor harvest this past season, has surpassed a tolerable threshold. The recurrent drought seems to be perpetuating this state of affairs..

Concerning industrial production, it is slowing down in spite of the growth recorded in 1979. This slowdown is due essentially to a serious restraint in peanut production which plays a leading part in the industry. The oil industry constitutes a major pillar of the industrial base.

The production index for the oil mills increased by 55.9% from the beginning of 1979 to the beginning of 1980 but fell 43.2% from 1979 to early 1980. Production in the food industries slumped in 1980.

Foreign trade is being negatively affected by the combined effects of poor crop years and the fluctuations in world commodity prices (especially peanuts).

The value of exported peanut products reached 17.1 billion CFA in December 1980. That is a decrease of 59.2% compared to December, 1979

Phosphate exports did not offset peanut exports as the quantity sold decreased even though world prices were high due to the increasing value of the dollar.

Imports into the country grew rapidly through the end of 1979 but slowed down by the end of 1980.

In summary, the economic situation of Senegal is not improving with a growth in gross domestic product from 139.8 billion CFA in the primary sector in 1977, to 157.4 billion in 1978 (a variation of 33.9%), only to fall by 9.78% in 1980, to a total of 142.1 billion. In the secondary sector, there was a 9% drop from 1977 to 1978 and 6.8% from 1979 to 1980. The gross domestic product in 1980 was 121.1 billion CFA.

In summary, there has been a drop in the gross domestic product, a persistent deficit in the trade balance and an unfavorable external position. The sector having the greatest influence in this situation is agriculture and, therefore, trade and industry which are more or less tied to it.

In spite of all, the fishing industry and livestock sector seem to offer a good possibility of altering the consequences of the present unfavorable recession.

II. The Livestock Sub-Sector:

The national herd has been hard hit by the recurrent drought since 1972.

Nevertheless, since 1977, there has been herd rebuilding due to major interventions such as the "operation sauvegarde du bétail" (annual supplemental feeding of livestock in the late dry season).

In 1977, there were:

2,514,000 head of cattle of which 340,000 were in Senegal Oriental.
Herd growth was 2,9%.

2,811,000 head of small ruminants of which 167,000 were in Senegal Oriental. Growth rate was 5,79%.

Total value of the national herd was estimated at 141 billion CFA in 1977, based on 1975 prices.

The herd is being rebuilt little by little from the effects of drought due to better veterinary coverage despite the limited means available.

In addition, the livestock industry is beginning, although only modestly, its integration into a regional agricultural and livestock system. It is also rapidly increasing in value due, to significant rises in prices for animal products.

The 5th development plan envisioned an important role for livestock in an attempt to systematically reduce or eliminate Senegal's dependence on neighboring countries to meet its national demand for animal products.

Among other projects, Senegal advocated:

- The development of cattle husbandry in the sylvo-pastoral zone.
- Improvement of livestock production in Senegal Oriental.
- Interventions for livestock production in the Casamance.

The drought, due to both its length and intensity, was the major obstacle to the achievement of these objectives. It contributed in decreasing fertility rates in females and aggravated animal mortality rates.

Losses were estimated at more than 20% and productivity decreased due to shortage and chronic mal-nutrition.

There are, of course, temporary difficulties contingent upon the drought, but structural obstacles are more significant for qualitative changes over the medium to long term.

The system suffers from poor organization at both the level of production as well as marketing. There is a manifest lack of means to establish a systematic policy on water development which is a major constraint. From an organizational standpoint, the cooperative system is not developed.

However, the major policy orientations are clearly defined:

- Eliminate the need for imports of meat and milk.
- Stratify the country into five ecological zones as follows for real, inter-regional complementarity in production:
 - The sylvo-pastoral zone as a cow-calf area.
 - The Fleuve-Senegal (River Region) for intensive forage production and integration of livestock and agriculture.
 - The peanut basin for fattening of animals.
 - Casamance and the southern part of Senegal Oriental; cow-calf, stocker-calf, and fattening.
 - Cap-Vert: intensive fattening of cattle with high production potential in modern feedlots.

The following points, for a rapid development of livestock production must be emphasized:

- Sedentarization of herds.
- Rational and complete utilization of agro-industrial by-products.
- Restructuring of the present production system by the introduction of forage crops. Intensification and specialization are a necessity.

III. Economic Analysis of the Project:

Project benefits will be analyzed on the basis of the following orientations:

- Herd growth which manifests itself in cattle numbers as well as quality.
- Marketing of livestock for meat at the local level or in other parts of the country.

The project has among its basic objectives the quantitative change of the traditional production system into one based more clearly on profits.

- Milk production for marketing, which is undeniably important, but also for the nutritional well-being of the population in the project area.

The wide scale local consumption, therefore, will be taken into account in order to be as close as possible to project realities and constraints.

A. Methodology and Assumptions

The internal rate of return has been calculated considering two variants.

The first variant is based on present project costs including all expenditures related to infrastructure and interventions of "promotion humaine".

The second variant decreases costs to a large extent from the third to the sixth year of the project. The costs taken out include 90% of costs for administrative centers and for Promotion Humaine. The joint evaluation and project redesign indicated these investments were of dubious value to the project per se. This is not to infer that there has been no justification for these inputs, but rather, in retrospect, that their marginal utility falls outside the framework of production as measured by economic analysis.

For the determination of project benefits, we have made a distinction in production assumptions between cattle and small ruminants.

Then, for determination of that portion of benefits arising from local consumption, we have assumed that this will be large in the beginning of the project and will decrease as attitudes change due to beneficial effects of the project.

Finally, the following assumptions for livestock production have been considered.

B. Summary of AssumptionsCattleWith the Project /Without the Project

| | | |
|--------|--|--------|
| 17,531 | Cattle numbers, 1975 | 17531 |
| 23,000 | Cattle numbers, 1981 | 21226 |
| 14.0% | Offtake rate | 10.0% |
| 57% | Per cent mature females in the Herd | 52% |
| 5.5% | Herd growth | 3.9% |
| 275Kg | Weight of Marketed Animals | 250Kg |
| \$0.67 | Price per kg live weight for market animals | \$0.67 |
| \$0.33 | Value per kg live weight for herd growth | \$0.33 |
| 150L | Milk production per cow per year for human consumption | 150L |
| 65% | Fertility rate | 60% |
| \$0.76 | Price of milk per liter | \$0.76 |

Sheep & GoatsWith the ProjectWithout the Project

| | | |
|--------|---|--------|
| 5,871 | Sheep numbers, 1975 | 5871 |
| 8000 | Sheep numbers, 1981 | 6,806 |
| 43% | Off take rate | 25% |
| 57% | Per cent producing females in the herd | 52% |
| 5.5% | Herd Growth | 3.0% |
| \$1.00 | Price per kg live weight for market animals | \$1.00 |
| \$0.50 | Value per kg live weight for herd growth | \$0.50 |
| 100L | Milk production per female per year for human consumption | 75L |
| 125% | Fertility rate | 110% |
| \$0.76 | Price of milk per liter | \$0.76 |

Range Capacity

Range capacity equals 25,000 Tropical Bovine Units (UBT). One UBT equals 250 kg of bovine. The average animal in a traditional cattle herd comprised of all ages of cattle equals 0.75 UBT. Five small ruminants equals one UBT.

With the attainment of full range capacity and the projected marketing structure, the offtake rate will increase to 19.5% instead of 14% in year 11 so that livestock numbers remain stable. Also by this time the increase in monetary requirements brought about by a more effective integration of the eastern part of the country into the national economy will permit the herder to consider livestock raising simply as a business like rice or cotton production.

At 5.5 percent growth rate, range capacity will be reached in year 11. Herd growth should be stabilized at this point by an increase in offtake of 5.5 percent or from 14 percent to 19.5 percent. In actual production, of course, these changes are not made in a one year period. It is recognized that 19.5 percent, even under a 0 percent herd growth situation, is a relatively high-level of production, but it is attained in some herds in Sudan and is a feasible level of production.

Further, as noted in the PP amendment, there has not been much research done in the project to measure progress resulting from project interventions. As a result most parameters used in the economic analysis were those used in the original PP in 1973-74. Some have been modified when more exact information is known. While we would not want to over stress our confidence in these exact numbers, the magnitude of change, is realistic, and this change is what gives rise to the economic benefits.

Milk production for cattle has been evaluated at 175 liters instead of 150 liters beginning in the tenth year. In effect, given the more or less modernization of livestock husbandry, the system of pasture and forage management will permit cows to produce more than under the present circumstances in which both water and grass are scarce and expensive.

Benefits calculated in this way cannot, of course, be considered as cash in hand. The food habits and especially the strong, traditional social structure dictate a very operational approach-that of local consumption.

We have estimated that over the life of the project, local consumption represents 60% in the first ten years of the project, 50% from the 11 to 15 years and 40% from years 16 to 20.

The percentage, important but real at the beginning, will decrease from the combined effects of integration and monetization of the regional economy, as well as from the effect of the project reaching range stocking capacity in its eleventh year.

Project benefits are important especially as one tries to evaluate what they would have been without project inputs. Projected annual benefits are found in tables 7 and 8 and give a constant comparison between the two species (small ruminants and cattle), and between effects with and without the project.

The accrued benefits could permit the financing of not only other complementary activities for survival of the project, but especially the effective involvement of herder's in the management of their future activities which are tied directly to livestock husbandry.

A tax system would permit financing of the marketing structure which is to play the major role in an effective transition from a traditional and sentimental to a modernized production system, capable of helping meet the food deficits in the area as well as in the country as a whole.

Project economic benefits, calculated with reduced infrastructure and Promotion Humaine costs show that viability depends only on effective involvement of the target group.

Internal rates of return are 4.4% and 14.4% respectively for the two methods of calculation.

These rates were calculated from monetary returns estimated according to the given assumptions.

The cost/benefit ratios were established as follows:

We have updated project benefits on the basis of both variants. The present value is based on a 10% discount rate which is close to the rate for preferred investment priorities.

The ratios are 12% for the first variant and 15% for the second. One can say from these two criteria (internal rate of return and ratio) which is economically the better variant.

However, the infrastructure and "Promotion Humaine" activities have effects which are not directly quantifiable but may be necessary for project survival.

In any case, the most fundamental objective is the improvement of human conditions, in this instance the herder, who is engine and recipient of this development. The sensitizing and training provided by "Promotion Humaine" respond to their concern to effectively involve the population.

An important element of the project is also the improvement of the environment (agro-sylvo-pastoral equilibrium). Activities proposed under the project tend towards these objectives. They are:

- intensification and specialization of activities in nutrition, health and genetics;

- rational and extensive utilization of all by-products;
- sedentarization;
- change of the present production system through the introduction of cultivated forages.

Besides the quantifiable effects which are herd growth, milk production and marketing, there are indirect effects generated by the project.

Among others, there is better nutrition for which the effects are more or less measured by local consumption, the structural changes of the production system and the expected incomes from the project.

There is the supplemental income for the herders, the primary beneficiaries of the project, but also the employment created in the project area. The effects throughout can be noted at the level of market redistribution from turnover generated in the project area and also at the national level.

The effects can also be noted at the level of the trade balance for the country which will be improved with an increased local production of meat and milk.

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HERD GROWTH
FOR CATTLE

Growth X est cost of newborn animal
(up to 1 year)

| Years | Herd Size | | Herd growth | | Value of herd growth | |
|-------|--------------|-----------------|--------------|-----------------|----------------------|-------------------------|
| | With Project | Without Project | With Project | Without Project | With Project \$ (68) | Without Project \$ (61) |
| 1 | 17.531 | 17.531 | 5.5% | 3.9% | - | - |
| 2 | 18.512 | 18.214 | 981 | 683 | 66.708 | 41663 |
| 3 | 19.549 | 18.925 | 1.037 | 711 | 70516 | 43371 |
| 4 | 20.644 | 19.663 | 1.095 | 738 | 74460 | 45018 |
| 5 | 21.800 | 20.430 | 1.156 | 767 | 78608 | 46787 |
| 6 | 23.000 | 21.226 | 1.200 | 796 | 81600 | 48556 |
| 7 | 24.265 | 22.054 | 1.265 | 828 | 86020 | 50508 |
| 8 | 25.599 | 22.914 | 1.334 | 860 | 90712 | 52460 |
| 9 | 27.007 | 23.808 | 1.408 | 894 | 95744 | 54534 |
| 10 | 28.492 | 24.736 | 1.485 | 928 | 100920 | 56608 |
| 11 | 30.060 | 25.701 | 1.563 | 965 | 106624 | 58865 |
| 12 | - | 26.704 | - | 1.003 | - | 61183 |
| 13 | - | 27.745 | - | 1.041 | - | 63501 |
| 14 | - | 28.827 | - | 1.082 | - | 66002 |
| 15 | - | 29.951 | - | 1.124 | - | 68564 |

CATTLE MARKETING

| Years | Herd Size | | Value off take | | Benefit |
|-------|--------------|-----------------|------------------------------------|---------------------------------------|-----------|
| | With Project | Without project | with 14% project (25.6 - 35.92) | Without 10% project (16.6 - 23.28) | |
| 1 | 17.531 | 17.531 | \$448.793 | 291.014 | \$157.779 |
| 2 | 18.512 | 18.214 | 473.907 | 302.352 | 171.555 |
| 3 | 19.549 | 18.925 | 500.454 | 314.155 | 186.299 |
| 4 | 20.644 | 19.663 | 528.486 | 326.405 | 202.081 |
| 5 | 21.800 | 20.430 | 558.080 | 339.138 | 218.942 |
| 6 | 23.000 | 21.226 | 588.800 | 352.351 | 236.449 |
| 7 | 24.265 | 22.054 | 621.194 | 366.096 | 255.088 |
| 8 | 25.599 | 22.914 | 655.334 | 380.372 | 274.962 |
| 9 | 27.007 | 23.808 | 691.379 | 395.212 | 296.167 |
| 10 | 28.492 | 24.736 | 729.395 | 410.617 | 318.778 |
| 11 | 30.060 | 25.701 | 1079755 | 598319 | 481436 |
| 12 | 30060 | 25701 | 1079755 | 598319 | 481436 |
| 13 | 30060 | 25701 | 1079755 | 598319 | 481436 |
| 14 | 30060 | 25701 | 1079755 | 598319 | 481436 |
| 15 | 30060 | 25701 | 1079755 | 598319 | 481436 |
| 16 | 30060 | 25701 | 1079755 | 598319 | 481346 |
| 17 | 30060 | 25701 | 1079755 | 598319 | 481436 |
| 18 | 30060 | 25701 | 1079755 | 598319 | 481436 |
| 19 | 30060 | 25701 | 1079755 | 598319 | 481346 |
| 20 | 30060 | 25701 | 1079755 | 598319 | 481436 |

MILK PRODUCTION FOR CATTLE

| Years | Females | | Productive cows | | Value of milk Product | | Benefit |
|-------|--------------------|-----------------------|--------------------|---------------------|-----------------------|-----------------|---------|
| | With Project (57%) | Without Project (52%) | With Project (55%) | Without 60% Project | With Project | Without Project | |
| 1 | 9.992 | 9.116 | 6494 | 5469 | \$740316 | 623466 | 116850 |
| 2 | 10.551 | 9.471 | 6858 | 5682 | 781812 | 647748 | 134064 |
| 3 | 11.142 | 9.841 | 7242 | 5904 | 825588 | 673056 | 152532 |
| 4 | 11.767 | 10.224 | 7648 | 6134 | 871872 | 699276 | 177596 |
| 5 | 12.426 | 10.623 | 8076 | 6373 | 920664 | 726522 | 194142 |
| 6 | 13.110 | 11.037 | 8521 | 6622 | 971394 | 754908 | 216486 |
| 7 | 13.831 | 11.466 | 8990 | 6830 | 1024860 | 784320 | 240540 |
| 8 | 14.591 | 11.915 | 9484 | 7149 | 1081176 | 814986 | 266190 |
| 9 | 15.393 | 12.380 | 10005 | 7428 | 1140570 | 846792 | 293778 |
| 10 | 16.240 | 12.862 | 10556 | 7717 | 1203384 | 879738 | 323646 |
| 11 | 17.134 | 13.364 | 11137 | 8018 | 1269618 | 914052 | 355566 |
| 12 | 17.134 | 13.886 | 11137 | 8331 | 1269618 | 949734 | 319884 |
| 13 | 17.134 | 14.427 | 11137 | 8656 | 1269618 | 986784 | 282834 |
| 14 | 17.134 | 14.990 | 11137 | 8994 | 1269618 | 1025316 | 244302 |
| 15 | 17.134 | 15.574 | 11137 | 9344 | 1269618 | 1065216 | 204402 |
| 16 | 17.134 | 15.574 | 11137 | 9344 | 1269618 | 1065216 | 204402 |
| 17 | 17.134 | 15.574 | 11137 | 9344 | 1269618 | 1065216 | 204402 |
| 18 | 17.134 | 15.574 | 11137 | 9344 | 1269618 | 1065216 | 204402 |
| 19 | 17.134 | 15.574 | 11137 | 9344 | 1269618 | 1065216 | 204402 |
| 20 | 17.134 | 15.574 | 11137 | 9344 | 1269618 | 1065216 | 204402 |

HERD GROWTH FOR SMALL RUMINANTS

Growth X value up to 1 year

| Years | Herd size | | Herd growth | | Value of herd growth | |
|-------|--------------|-----------------|--------------|-----------------|----------------------|-----------------|
| | With Project | Without Project | With Project | Without Project | With Project | Without Project |
| 1 | 5.871 | 5.871 | - | - | +\$20/animal | + \$18 |
| 2 | 6.245 | 6.047 | 374 | 176 | 7480 | 3168 |
| 3 | 6.644 | 6.228 | 399 | 181 | 7980 | 3258 |
| 4 | 7.068 | 6.015 | 424 | 187 | 8480 | 3366 |
| 5 | 7.520 | 6.607 | 452 | 192 | 9040 | 3456 |
| 6 | 8.000 | 6.806 | 490 | 199 | 9800 | 3582 |
| 7 | 8.440 | 7.010 | 440 | 204 | 8800 | 3672 |
| 8 | 8.904 | 7.220 | 464 | 210 | 9280 | 3780 |
| 9 | 9.393 | 7.437 | 489 | 217 | 9780 | 3906 |
| 10 | 9.910 | 7.660 | 517 | 223 | 10340 | 4014 |
| 11 | 10.455 | 7.890 | 545 | 230 | 10900 | 4140 |
| 12 | - | 8.126 | - | 236 | - | 4248 |
| 13 | - | 8.370 | - | 244 | - | 4392 |
| 14 | - | 8.621 | - | 251 | - | 4518 |
| 15 | - | 8.880 | - | 299 | - | 5382 |
| 16 | - | 9.146 | - | 266 | - | 4788 |
| 17 | - | 9.421 | - | 275 | - | 4950 |
| 18 | - | 9.703 | - | 282 | - | 5076 |
| 19 | - | 9.994 | - | 291 | - | 5238 |
| 20 | - | 10.294 | - | 300 | - | 5400 |

SMALL RUMINANT MARKETING

| Years | Herd size | | Value of off take | | Benefit |
|-------|--------------|--------------|----------------------------|-------------------|---------|
| | With project | Without Pro. | With project 17, 2 - 19 | Without pro. 9 | |
| 1 | 5.871 | 5.871 | 100981 | 52839 | 48142 |
| 2 | 6.245 | 6.047 | 107414 | 54423 | 52991 |
| 3 | 6.644 | 6.228 | 114276 | 56052 | 58224 |
| 4 | 7.068 | 6.415 | 121569 | 57735 | 63834 |
| 5 | 7.520 | 6.607 | 129344 | 59463 | 69881 |
| 6 | 8.000 | 6.806 | 137600 | 61254 | 76346 |
| 7 | 8.440 | 7.010 | 141168 | 63090 | 78078 |
| 8 | 8.904 | 7.220 | 153148 | 64980 | 88168 |
| 9 | 9.393 | 7.437 | 161559 | 66933 | 94626 |
| 10 | 9.910 | 7.660 | 170452 | 68940 | 101512 |
| 11 | 10.455 | 7.890 | 179826 | 71010 | 108816 |
| 12 | 10455 | 8.126 | 198645 | 73134 | 125511 |
| 13 | 10455 | 8.370 | 198645 | 75330 | 123315 |
| 14 | 10455 | 8.621 | 198645 | 77589 | 121056 |
| 15 | 10455 | 8.880 | 198645 | 79920 | 118725 |
| 16 | 10455 | 9.143 | 198645 | 83314 | 115331 |
| 17 | 10455 | 9.421 | 198645 | 84789 | 113856 |
| 18 | 10455 | 9.703 | 198645 | 87327 | 111318 |
| 19 | 10455 | 9.994 | 198645 | 89946 | 108699 |
| 20 | 10455 | 10.294 | 198645 | 92646 | 105999 |

...//...

MILK PRODUCTION FOR SMALL RUMINANTS

| Years | Females in herd | | Productives females | | Value of milk product° | | Benefit of project |
|-------|------------------|---------------------|---------------------|---------------------|------------------------|--------------------|--------------------|
| | With 57% project | Without project 52% | With 12.5% project | Without project 10% | With 76 project | Without 57 project | |
| 1 | 3346 | 3052 | 4182 | 3357 | \$ 317,832 | 191349 | 126483 |
| 2 | 3559 | 3144 | 4448 | 3458 | 338048 | 197106 | 140942 |
| 3 | 3787 | 3238 | 4733 | 3561 | 359708 | 202977 | 156731 |
| 4 | 4028 | 3127 | 5035 | 3439 | 382660 | 196023 | 186637 |
| 5 | 4286 | 3435 | 5357 | 3778 | 407132 | 215346 | 191786 |
| 6 | 4560 | 3539 | 5700 | 3892 | 433200 | 221844 | 211356 |
| 7 | 4810 | 3645 | 6012 | 4009 | 456912 | 228513 | 228399 |
| 8 | 5075 | 3754 | 6343 | 4129 | 482068 | 235353 | 246715 |
| 9 | 5354 | 3867 | 6692 | 4253 | 508592 | 242421 | 266171 |
| 10 | 5648 | 3983 | 7060 | 4381 | 536560 | 249717 | 286843 |
| 11 | 5959 | 4102 | 7448 | 4512 | 566048 | 257184 | 308864 |
| 12 | 5959 | 4225 | 7448 | 4647 | 566048 | 264879 | 301169 |
| 13 | 5959 | 4352 | 7448 | 4787 | 566048 | 272859 | 293189 |
| 14 | 5959 | 4482 | 7448 | 4930 | 566048 | 281010 | 285038 |
| 15 | 5959 | 4617 | 7448 | 5078 | 566048 | 289446 | 276602 |
| 16 | 5959 | 4755 | 7448 | 5230 | 566048 | 298110 | 267938 |
| 17 | 5959 | 4898 | 7448 | 5387 | 566048 | 307059 | 258989 |
| 18 | 5959 | 5045 | 7448 | 5549 | 566048 | 316293 | 249755 |
| 19 | 5959 | 5196 | 7448 | 5715 | 566048 | 325755 | 240293 |
| 20 | 5959 | 5352 | 7448 | 5887 | 566048 | 335559 | 230489 |

SUMMARY OF BENEFITS FOR CATTLE

| Years | With Project | | | Total | Without Project | | | Total |
|-------|---------------------|-----------|-----------------|---------|-----------------|----------|-----------------|---------|
| | \$Value Herd growth | Off take | Milk Production | | Herd growth | Off take | Milk Production | |
| 1 | | \$448.793 | \$ 740316 | 1189109 | | 291.014 | 623466 | 914480 |
| 2 | 66708 | 473.907 | 781812 | 1322427 | 41663 | 302.352 | 647748 | 991763 |
| 3 | 70516 | 500.454 | 825588 | 1396558 | 43371 | 314.155 | 673056 | 1030582 |
| 4 | 74460 | 528.486 | 871872 | 1474818 | 45018 | 326.405 | 699276 | 1070699 |
| 5 | 78608 | 558.080 | 920664 | 1557352 | 46787 | 339138 | 726522 | 1112447 |
| 6 | 81600 | 588.800 | 971394 | 1641794 | 48556 | 352.351 | 754908 | 1155815 |
| 7 | 86020 | 621.184 | 1024860 | 1732064 | 50508 | 366.096 | 784320 | 1200924 |
| 8 | 90712 | 655.334 | 1081176 | 1827222 | 52460 | 380372 | 814986 | 1247818 |
| 9 | 95744 | 691.379 | 1140570 | 1922693 | 54534 | 395212 | 846792 | 1296538 |
| 10 | 100980 | 729.395 | 1203384 | 2033759 | 56608 | 410.617 | 879738 | 1346963 |
| 11 | 106624 | 1079755 | 1269618 | 2455997 | 58865 | 598319 | 914052 | 1571236 |
| 12 | - | 1079755 | 1269618 | 2349373 | 61183 | 598319 | 949734 | 1609236 |
| 13 | - | 1079755 | 1269618 | 2349373 | 65501 | 598319 | 986784 | 1650604 |
| 14 | - | 1079755 | 1269618 | 2349373 | 66002 | 598319 | 1025316 | 1689637 |
| 15 | - | 1079755 | 1269618 | 2349373 | 68564 | 598319 | 1065216 | 1732099 |
| 16 | - | 1079755 | 1269618 | 2349373 | - | 598319 | 1065216 | 1663535 |
| 17 | - | 1079755 | 1269618 | 2349373 | - | 598319 | 1065216 | 1663535 |
| 18 | - | 1079755 | 1269618 | 2349373 | - | 598319 | 1065216 | 1663535 |
| 19 | - | 1079755 | 1269618 | 2349373 | - | 598319 | 1065216 | 1663535 |
| 20 | - | 1079755 | 1269618 | 2349373 | - | 598319 | 1065216 | 1663535 |

SUMMARY OF BENEFITS FOR SHEEP/GOATS

| Years | With Project | | | Total | Without Project | | | Total |
|-------|--------------|----------|-----------------|--------|-----------------|----------|-----------------|--------|
| | Herd growth | Off take | Milk production | | Herd growth | Off take | Milk production | |
| 1 | - | 100981 | 317832 | 418813 | | 52839 | 191349 | 244188 |
| 2 | 7480 | 107414 | 338048 | 452942 | 3168 | 54423 | 197106 | 254697 |
| 3 | 7980 | 114276 | 359708 | 481964 | 3258 | 56052 | 202977 | 262287 |
| 4 | 8480 | 121569 | 382660 | 544085 | 3366 | 57735 | 196023 | 257124 |
| 5 | 9040 | 129344 | 407132 | 545516 | 3456 | 59463 | 215346 | 278265 |
| 6 | 9600 | 137600 | 433200 | 580400 | 3582 | 61254 | 221844 | 286680 |
| 7 | 8800 | 141168 | 456912 | 606880 | 3672 | 63090 | 228513 | 295275 |
| 8 | 9280 | 153148 | 482068 | 644496 | 3780 | 64980 | 235353 | 304113 |
| 9 | 9780 | 161559 | 508592 | 679931 | 3906 | 66933 | 242421 | 313260 |
| 10 | 10340 | 170452 | 536560 | 717352 | 4014 | 68940 | 249717 | 322671 |
| 11 | 10900 | 179826 | 566048 | 756774 | 4140 | 71010 | 257184 | 332334 |
| 12 | - | 198645 | 566048 | 764693 | 4243 | 73134 | 264879 | 342261 |
| 13 | - | 198645 | 566048 | 764693 | 4392 | 75330 | 272859 | 352581 |
| 14 | - | 198645 | 566048 | 764693 | 4518 | 77539 | 281010 | 363117 |
| 15 | - | 198645 | 566048 | 764693 | 5382 | 79920 | 289446 | 374748 |
| 16 | - | 198645 | 566048 | 764693 | 4788 | 83314 | 298110 | 386212 |
| 17 | - | 198645 | 566048 | 764693 | 4950 | 84789 | 307059 | 396798 |
| 18 | - | 198645 | 566048 | 764693 | 5076 | 87327 | 316293 | 408696 |
| 19 | - | 198645 | 566048 | 764693 | 5238 | 89946 | 325755 | 420939 |
| 20 | - | 198645 | 566048 | 764693 | 5400 | 92646 | 335539 | 433585 |

INCREMENTAL BENEFITS OF PROJECT

| Years itens | Cattle benefits | Small ruminants benefits | Total benefits |
|----------------|--------------------|-----------------------------|-------------------|
| 1 | \$ 274629 | 174625 | \$ 449254 |
| 2 | 330664 | 198245 | 528909 |
| 3 | 365976 | 219677 | 585653 |
| 4 | 404119 | 286961 | 691080 |
| 5 | 444905 | 267251 | 712156 |
| 6 | 485979 | 293720 | 779699 |
| 7 | 531140 | 311605 | 842745 |
| 8 | 579404 | 340383 | 919787 |
| 9 | 631155 | 366671 | 997826 |
| 10 | 686796 | 394681 | 1081477 |
| 11 | 884761 | 424440 | 1309201 |
| 12 | 740137 | 422432 | 1162569 |
| 13 | 698769 | 412112 | 1110881 |
| 14 | 659736 | 401576 | 1061312 |
| 15 | 617274 | 389445 | 1007219 |
| 16 | 685838 | 378481 | 1064319 |
| 17 | 685838 | 267895 | 1053733 |
| 18 | 685838 | 355997 | 1041835 |
| 19 | 685838 | 343754 | 1029592 |
| 20 | 685838 | 331108 | 1016946 |

CALCULATION OF CASH BENEFITSAssumptions

| | | |
|------|--------------------------------|-----------|
| 60 % | decline of consumption 1 to 10 | Cash 40 % |
| 50 % | 10 to 15 | 50 % |
| 40 % | 15 to 20 | 60 % |

| Years | Total benefits | Cash benefits to herders |
|-------|----------------|--------------------------|
| 1 | 449254 | 179701 |
| 2 | 528909 | 211563 |
| 3 | 585653 | 234261 |
| 4 | 691080 | 276432 |
| 5 | 712156 | 284862 |
| 6 | 779699 | 311879 |
| 7 | 842745 | 337098 |
| 8 | 919787 | 367914 |
| 9 | 997826 | 399130 |
| 10 | 1081477 | 432580 |
| 11 | 1309201 | 654600 |
| 12 | 1162569 | 581284 |
| 13 | 1110881 | 555440 |
| 14 | 1061312 | 530656 |
| 15 | 1007219 | 503609 |
| 16 | 1064319 | 638591 |
| 17 | 1053733 | 632239 |
| 18 | 1041835 | 625101 |
| 19 | 1029592 | 617755 |
| 20 | 1016946 | 610167 |

COSTS

| Years/items | GOS and USG Actual cost \$ US 1000 | Adjusted costs \$ US 1000 |
|-------------|--|------------------------------|
| 1 | 81 | 81 |
| 2 | 316 | 316 |
| 3 | 874 | 437 |
| 4 | 1,055 | 510 |
| 5 | 412 | 362 |
| 6 | 487 | 574 |
| 7 | 688 | 688 |
| 8 | 688 | 688 |
| 9 | 688 | 688 |
| 10 | 100 | 100 |
| 11 | 100 | 100 |
| 12 | 100 | 100 |
| 13 | 100 | 100 |
| 14 | 100 | 100 |
| 15 | 100 | 100 |
| 16 | 100 | 100 |
| 17 | 150 | 150 |
| 18 | 100 | 100 |
| 19 | 100 | 100 |
| 20 | 100 | 100 |

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TABLE 12

ANALYSIS OF SENEGAL LIVESTOCK (ACTUAL COST) #1 Variant I 10% R

UNITS: US DOLLARS

| YEAR | -----PROJECT----- | | --DISCOUNTED (10 %)-- | | CASH FLOW |
|--------|-------------------|-------------|------------------------|-------------|-------------|
| | COST | BENEFITS | COST | BENEFITS | |
| 1 | 81,000. | 179,701. | 73,636. | 163,365. | 98,701. |
| 2 | 316,000. | 211,563. | 261,157. | 174,845. | %-104,437. |
| 3 | 874,000. | 234,261. | 656,649. | 176,004. | %-639,739. |
| 4 | %1,055,000. | 276,432. | 720,579. | 188,807. | %-778,568. |
| 5 | 412,000. | 284,862. | 255,820. | 176,877. | %-127,138. |
| 6 | 487,000. | 311,879. | 274,899. | 176,048. | %-175,121. |
| 7 | 688,000. | 337,098. | 353,053. | 172,985. | %-350,902. |
| 8 | 688,000. | 367,914. | 320,957. | 171,635. | %-320,086. |
| 9 | 688,000. | 399,180. | 291,779. | 169,291. | %-288,820. |
| 10 | 100,000. | 432,580. | 38,554. | 166,778. | 332,580. |
| 11 | 100,000. | 654,600. | 35,049. | 229,433. | 554,600. |
| 12 | 100,000. | 581,284. | 31,863. | 185,215. | 481,284. |
| 13 | 100,000. | 555,440. | 28,966. | 160,891. | 455,440. |
| 14 | 100,000. | 530,656. | 26,333. | 139,738. | 430,656. |
| 15 | 100,000. | 503,609. | 23,939. | 120,560. | 403,609. |
| 16 | 100,000. | 638,591. | 21,763. | 138,976. | 538,591. |
| 17 | 100,000. | 632,239. | 19,784. | 125,085. | 532,239. |
| 18 | 100,000. | 625,101. | 17,986. | 112,430. | 525,101. |
| 19 | 100,000. | 617,755. | 16,351. | 101,008. | 517,755. |
| 20 | 100,000. | 610,167. | 14,864. | 90,697. | 510,167. |
| TOTALS | %6,389,000. | %8,984,910. | %3,483,980. | %3,140,670. | %2,595,910. |

B/C RATIO = .901459 NPV = -343315 IRR = 7.27038 %

ANALYSIS OF SENEGAL LIVESTOCK (ACTUAL COST) #1 Variant I 15% R

UNITS: US DOLLARS

| YEAR | -----PROJECT----- | | --DISCOUNTED (15 %)-- | | CASH FLOW |
|--------|-------------------|-------------|------------------------|-------------|-------------|
| | COST | BENEFITS | COST | BENEFITS | |
| 1 | 81,000. | 179,701. | 70,435. | 156,262. | 98,701. |
| 2 | 316,000. | 211,563. | 238,941. | 159,972. | %-104,437. |
| 3 | 974,000. | 234,261. | 574,669. | 154,030. | %-639,739. |
| 4 | %1,055,000. | 276,432. | 603,200. | 158,051. | %-778,568. |
| 5 | 412,000. | 284,862. | 204,837. | 141,627. | %-127,138. |
| 6 | 487,000. | 311,879. | 210,544. | 134,834. | %-175,121. |
| 7 | 688,000. | 337,098. | 258,645. | 126,728. | %-350,902. |
| 8 | 688,000. | 367,914. | 224,908. | 120,272. | %-320,086. |
| 9 | 688,000. | 399,180. | 195,573. | 113,472. | %-288,820. |
| 10 | 100,000. | 432,580. | 24,718. | 106,927. | 332,580. |
| 11 | 100,000. | 654,600. | 21,494. | 140,702. | 554,600. |
| 12 | 100,000. | 581,284. | 18,691. | 108,646. | 481,284. |
| 13 | 100,000. | 555,440. | 16,253. | 90,275. | 455,440. |
| 14 | 100,000. | 530,656. | 14,133. | 74,997. | 430,656. |
| 15 | 100,000. | 503,609. | 12,289. | 61,891. | 403,609. |
| 16 | 100,000. | 638,591. | 10,686. | 68,243. | 538,591. |
| 17 | 100,000. | 632,239. | 9,293. | 58,751. | 532,239. |
| 18 | 100,000. | 625,101. | 8,081. | 50,511. | 525,101. |
| 19 | 100,000. | 617,755. | 7,027. | 43,407. | 517,755. |
| 20 | 100,000. | 610,167. | 6,110. | 37,281. | 510,167. |
| TOTALS | %6,389,000. | %8,984,910. | %2,730,530. | %2,106,880. | %2,595,910. |

B/C RATIO = .771602 NPV = -623648 IRR = 7.27038 %

CALCULATION OF THE INTERNAL RATE OF RETURN
(VARIANT II)

| Years | Adjusted Cost | Cash benefits | Net benefits | Present worth | |
|-------|---------------|---------------|--------------|---------------|----------|
| | | | | 10 % | 15 % |
| 1 | 81.000 | 179701 | 98701 | 89719 | 85869 |
| 2 | 316.000 | 211563 | - 104437 | - 86264 | - 60155 |
| 3 | 574.000 | 234261 | - 339739 | - 255143 | - 223548 |
| 4 | 510.000 | 276432 | - 233568 | - 159526 | - 133600 |
| 5 | 362.000 | 284862 | - 77138 | - 47902 | - 38337 |
| 6 | 437.000 | 311879 | - 125121 | - 70568 | - 54052 |
| 7 | 683.000 | 337096 | - 350902 | - 180012 | - 131939 |
| 8 | 688.000 | 367914 | - 320086 | - 149480 | - 104668 |
| 9 | 683.000 | 399110 | - 288890 | - 122489 | - 82044 |
| 10 | 100.000 | 432580 | 332580 | 128375 | 82147 |
| 11 | 100.000 | 654600 | 554600 | 194110 | 119239 |
| 12 | 100.000 | 581284 | 481284 | 153529 | 90000 |
| 13 | 100.000 | 555440 | 455440 | 132077 | 74236 |
| 14 | 100.000 | 530656 | 430656 | 113262 | 60722 |
| 15 | 100.000 | 503609 | 403609 | 96462 | 49643 |
| 16 | 100.000 | 638591 | 538591 | 117412 | 57629 |
| 17 | 100.000 | 632239 | 532239 | 105383 | 49498 |
| 18 | 100.000 | 625101 | 525101 | 94518 | 42533 |
| 19 | 100.000 | 617755 | 517755 | 84911 | 36242 |
| 20 | 100.000 | 610167 | 510167 | 76014 | 31120 |
| | | | | + 317888 | - 49465 |

The IRR for this variant is approximately 14%.

TABLE 14

COST BENEFIT RATIO

| Years | Actual costs | Adjusted cost | Present worth Costs 10% Discount Rate | |
|-------|--------------|---------------|--|---------------|
| | | | Actual Cost | Adjusted Cost |
| 1 | 81.000 | 81.000 | 73.629 | 73.629 |
| 2 | 316.000 | 316.000 | 261.016 | 261.016 |
| 3 | 874.000 | 574.000 | 656.374 | 431.074 |
| 4 | 1.055.000 | 510.000 | 720.565 | 348.330 |
| 5 | 412.000 | 362.300 | 255.852 | 224.802 |
| 6 | 487.000 | 437.000 | 274.668 | 246.468 |
| 7 | 688.000 | 688.000 | 353.053 | 353.053 |
| 8 | 688.000 | 688.000 | 320.957 | 320.957 |
| 9 | 688.000 | 688.000 | 291.780 | 291.780 |
| 10 | 100.000 | 100.000 | 38.600 | 38.600 |
| 11 | 100.000 | 100.000 | 35.000 | 35.000 |
| 12 | 100.000 | 100.000 | 31.900 | 31.900 |
| 13 | 100.000 | 100.000 | 29.000 | 29.000 |
| 14 | 100.000 | 100.000 | 26.300 | 26.300 |
| 15 | 100.000 | 100.000 | 23.900 | 23.900 |
| 16 | 100.000 | 100.000 | 21.800 | 21.800 |
| 17 | 100.000 | 100.000 | 19.800 | 19.800 |
| 18 | 100.000 | 100.000 | 18.000 | 18.000 |
| 19 | 100.000 | 100.000 | 16.400 | 16.400 |
| 20 | 100.000 | 100.000 | 14.900 | 14.900 |

3,483.494

2,826.709

TABLE 15

Cost Benefit Ratio
Discounted Benefits

| Years | Cash Benefits | Present worth: 10% |
|-------|---------------|--------------------|
| 1 | 179.701 | 163.364 |
| 2 | 211.563 | 174.845 |
| 3 | 234.261 | 176.004 |
| 4 | 276.432 | 188.807 |
| 5 | 284.862 | 176.877 |
| 6 | 311.879 | 176.047 |
| 7 | 337.098 | 172.985 |
| 8 | 367.917 | 171.635 |
| 9 | 399.110 | 169.262 |
| 10 | 432.580 | 166.778 |
| 11 | 654.600 | 229.433 |
| 12 | 581.284 | 185.215 |
| 13 | 555.440 | 160.891 |
| 14 | 530.656 | 139.738 |
| 15 | 503.609 | 120.560 |
| 16 | 638.591 | 138.976 |
| 17 | 632.239 | 125.085 |
| 18 | 625.101 | 112.430 |
| 19 | 617.755 | 111.109 |
| 20 | 610.167 | 90.697 |
| | | <u>3,150.738</u> |

Socio-Political Soundness

This analysis will not concern itself with the Socio-political inappropriateness of the Toulekeddi/Sarre zone, no. 1 and no. 2, delimitations as they were proposed and implemented in earlier phases of this project. It will be assumed here that the boundary modifications recommended by the project administration on the basis of their implementation experience and the design team, on the basis of consultations with the former, will become operative.

These revised boundaries have been drawn as a function of current information on evolving range use patterns in and around the former Toulekeddi zone. The previous division between the plateau, Toulekeddi zone (no. 1) and the escarpment, Sarre zone (no. 2) was based on hydrogeological criteria. This demarcation failed to reflect the adaptational advantages (risk aversion, etc.) to a pastoral production system of straddling an ecological boundary. The concentration of villages along such a boundary, such as below the escarpment in the case of the project area, is a manifestation of this advantage.

By virtue of the findings of the project administration, the redesign team has proposed the following three implementation zones (see map,): page 27).

1. The Mbaniou zone: (approximately 900 people, 7,000 cattle, 2,000 goats) named for the villages beside which the project administration's subcenter has been constructed. This zone comprises all the villages included in the former Toulekedí zone and that range, within the Bakel department,* of most relevance to them. This range has not been found to extend, even to the eastern most village - Jare Mbolo, further than the central firebreak/access road transecting the old Toulekedí zone north to south at approximately 12°35' longitude. There is one village Sawol, which fell between the zone being developed through the IBRD - financed Eastern Senegal livestock project and that included in the old Toulekedí zone of the USAID project to the east. As this village is geographically and sociologically linked to the Toulekedí - Mbaniou - Jare - Mbolo triangle of villages (see map), it will be availing itself of project infrastructure in any case, and so has been formally added to the project scope.

2. The Ololdou zone: (1,461 people, 5,200 cattle, 2,068 goats): Named for the "chef-lieu d'arrondissement" lying between the plateau escarpment and the Senegal River. This area includes 21 hamlets that have been de facto project beneficiaries by virtue of their proximity to and use of the first dug pond lying to the northeast of the old Toulekedí zone. On account of this de facto involvement, the project administration named this group as the buffer zone (zone tampon). Expanded to include the relevant area of the old Toulekedí range, this zone would lie between the

*These villages and to an even greater extent, those in the Ololdou zone to some grazing to the north in the Matam department for up to 2 months immediately after the rains.

Southern boundary of the Ololdou arrondissement, and the chef lieu itself.

3. The Sainthiou - Fisa zone: (Zone d'Escarpment) (1,500 people, approximately 8,000 cattle) South of the Ololdou arrondissement, in the Goudiry arrondissement. This continues to be a concentrated string of 14 villages running North-South in the shadow of the escarpment taking advantage of the same ecological variety as do the villages along the escarpment in the Ololdou arrondissement (zone no. 2). 8 of these 14 villages fell within the old Sarré zone of the project which also included three villages further to the east. These 8 villages are closer to the improvement in the eastern half of the Toulekedé zone than any of the villages (now comprised by the Mbaniou zone no. 1) in that zone. Therefore, that portion of the Toulekedé zone to the east of the central (12°35' longitude) firebreak have been attached to this new zone no. 3. To the south of these 8 villages, running in the same line along the same escarpment, are 6 more villages that have joined the northern 8 to form a "cooperatives des éleveurs" head-quartered at the southern most village along the railroad, Sainthiou Fisa. This budding organization corresponds to the ecological and geographical logic favoring the unification of these 14 villages into a single development zone. Furthermore, neither the southern 6 villages nor the plateau range area directly to the west of their escarpment (South of the Southern boundary of the old Toulekedé zone) ^{are} included in the "zone d'action" of the IBRD - financed livestock project. The policy of the USAID - financed project administration to include villages and range

areas left out of the Tambacounda based livestock development plan is a regional development necessity which the present project design whole - heartedly supports. However, as the present project purpose remains restricted to improvements emanating from pond development on the plateau, it can only incorporate villages capable of using that range area into its present plan. This leaves several villages north of the railroad and west of the Kidira-Bakel Road (the informal limit of SAED project activities) without a project. In the arrondissement of Ololdou this includes 3 villages in the old Sarré zone, including Sarré itself. In the arrondissement of Goudiry this includes Mama Sdao, Ebal and Juyan which, in addition to being far from the escarpment, and therefore from the plateau range, receive their livestock services from the Kidira veterinary post and have therefore not been included in the Sainthiou Fisa "cooperative des Eleveurs. These are only addressed in the present design to the extent that a water development feasibility study for the drainage area between the escarpment and the Bakel - Kidira Road is proposed.

Biogeographic Parameters of the three zones

Herein follows such quantitative information as is presently available for the three new project zones under discussion; flagrant inaccuracies are noted where known. The incompleteness of this and other more direct production data should be corrected by the monitoring component of the present design. Otherwise it will be difficult to measure the impact of the past and proposed inputs and, therefore, to justify their replication.

TABLE II

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The Ololdou Zone (Zone Tampon)

| Village | Active Population | | | | In-active population | | | | Total population | Cattle | Goats X | Donkeys | Horses | |
|------------------------------|-------------------|------|----------|-------|----------------------|------|-----------------------|------|------------------|--------|------------|---------|--------|-------|
| | Adult | | Children | Total | Adult | | Children less than 14 | | | | | | | |
| | Female | Male | 15-20 | | Female | Male | Female | Male | | | | | | Total |
| 1. Lombol | 7 | 7 | 3 | 17 | | | 2 | 6 | 8 | 25 | 210 | 65 | 4 | - |
| 2. Lombol Tebito | 18 | 20 | 3 | 41 | | | 16 | 17 | 35 | 76 | 183 | 65 | 2 | |
| 3. Cira Baidy | 11 | 12 | 2 | 25 | | | 9 | 3 | 14 | 39 | 200 | 40 | | 3 |
| 4. Cira Doundou | 9 | 10 | 3 | 22 | 2 | | 10 | 12 | 22 | 44 | 840 | 800 | 7 | 1 |
| 5. Cira Simbigne | 6 | 7 | 1 | 14 | 1 | | 1 | 3 | 17 | 31 | 145 | 125 | 4 | 1 |
| 6. Cira Sisibe (Samba Ngala) | 23 | 18 | 2 | 43 | 1 | | 18 | 19 | 38 | 81 | 50 | 60 | 3 | |
| 7. Cira Kalidou Kelepha | 6 | 4 | 1 | 11 | 1 | | 5 | 3 | 9 | 20 | 40 | 10 | 2 | 1 |
| 8. Cira Mamadou Bocar | 10 | 7 | 4 | 21 | | | 5 | 8 | 13 | 34 | 400 | 100 | 4 | 1 |
| 9. Cira Hamady Ousmane | 6 | 7 | 1 | 14 | | | 1 | 6 | 13 | 27 | 200 | 60 | 4 | |
| 10. Kadief Swadou | 3 | 5 | 2 | 10 | | | 1 | 4 | 5 | 19 | 435 | 150 | 21 | 2 |
| 11. Gourel Jaloube | 32 | 34 | 7 | 73 | 7 | | 40 | 27 | 74 | 147 | 110 | 50 | 3 | 4 |
| 12. Gourel Samba Jouberou | 18 | 19 | 4 | 41 | 1 | | 18 | 16 | 35 | 76 | 145 | 40 | | |
| 13. Medina Samba Gouro | 19 | 22 | 5 | 46 | | | 2 | 27 | 52 | 98 | 210 | 64 | 8 | 4 |
| 14. Sainthiou Thiengeled | 17 | 16 | | 33 | | | 19 | 12 | 31 | 64 | 50 | 14 | | |
| 15. Sainthiou Seydou Doro | 21 | 22 | 5 | 48 | 1 | | 25 | 9 | 36 | 84 | 900 | 50 | 8 | 4 |
| 16. Sainthiou Madina | 22 | 25 | 4 | 51 | | | 5 | 15 | 39 | 90 | 173 | 88 | 7 | 4 |
| 17. Madina Abdoul | 16 | 15 | 3 | 34 | | | 2 | 14 | 25 | 75 | 551 | 104 | 4 | 5 |
| 18. Magel Hamar | 3 | 7 | | 10 | 1 | | 1 | 5 | 7 | 17 | 50 | 4 | | 1 |
| 19. Mayel Fily | 9 | 9 | 4 | 22 | | | 1 | 20 | 33 | 55 | 45 | 39 | 2 | 1 |
| 20. Alalevy | 29 | 17 | 5 | 51 | 1 | | 4 | 14 | 37 | 88 | 53 | 92 | 8 | 2 |
| 21. Kahe | 51 | 84 | 7 | 142 | 1 | | 2 | 60 | 66 | 129 | 271 | 44 | 8 | 6 |
| TOTAL | 336 | 367 | 66 | 769 | 4 | 32 | 336 | 320 | 692 | 1,461 | 5,260 | 2,058 | 99 | 43 |

X Only Kadief Sawdou (with 251) has more than 13 sheep.

80

Table III

The Sainthiou Fiza, Escarpment Zone

| Villages | Human Population | Cattle | | | | Total* | Small ruminant | Donkeys & Horses |
|--|------------------|--------|--------|------|--------|-----------|----------------|------------------|
| | | Bulls | Steers | Cows | Calves | | | |
| (Running from North to South) | | | | | | | | |
| 1. Chiuke | 9 | | | | | | | |
| 2. FETA COLOMBI | 91 | 1 | 4 | 44 | 16 | 109 | - | - |
| 3. Tanga Jari | | | | | | | | |
| 4. Gourez Mama Ndiaye | | 1 | 2 | 32 | 10 | | | |
| 5. Birfal | | 14 | 20 | 148 | 52 | | | |
| 6. Wali Jala | | 33 | 38 | 306 | 142 | | | |
| 7. Gambi Jaube | | 12 | 26 | 155 | 58 | | | |
| 8. Seno Wandale | | 1 | 6 | 34 | 19 | | | |
| These 6 villages are all taxed with | | | | | | | | |
| 9. Urosole | 467 | | | | | 288 | 3,000 | 68 |
| 10. Seno Issaga | 81 | | | | | 221 | | |
| 11. Arigabou | 221 | | | | | 97 | | |
| 12. Gourez Buli | 82 | | | | | 146 | | |
| 13. Fiza Dahou | 37 | | | | | 44 | | |
| 14. Koun Del | 100 | | | | | 434 | | |
| 15. Sainthiou Fiza | 369 | | | | | 446 | | |
| Villages that fall between the Ferf project and the co-operative des éleveurs de Sainthiou Fiza: | | | | | | | | |
| 16. Seno Samba | 38 | | | | | 57 | | |
| 17. Yupe | 517 | | | | | 417 | | |
| | 1,447 | | | | | 1,785 x 4 | | |

x these "totals" representent the number of animals vaccinated by the service d'Elevage at Goudiry. As this was done during the dry season at least 3/4 of the village herd was absent. Therefore, this figure should be at least quadrupled.

Hence the approximate totals for the three new pastoral zones are:

| | <u>Population</u> | <u>Cattle</u> |
|--------|-------------------|---------------|
| Zone 1 | 1,000 | 7,000 |
| Zone 2 | 1,500 | 8,000 |
| Zone 3 | <u>1,500</u> | <u>8,000</u> |
| | 4,000 | 23,000 |

The question remains then, with further pond and village well improvements, will more nomadic pastoral populations come and camp longer in the project area, thereby frustrating the elaboration and extension of a more precise range management plan? I will return to this question after having first explored the implications of a more precise range management plan (to be developed out of the monitoring exercise of the project's next phase) for the populations within these zones.

I will begin with a brief recapitulation of the economic history of these 4,000 people.

Bundu

The Fouta (Toro) region of the middle-Senegal Valley has, over the last millenium, been the cradle of a series of economic specializations unsurpassed in West Africa for their caste-like intricacy. The ruling and owning lineages, Torobe, even kept themselves distinct, as far as marriage (and therefore natural identity) was concerned, from the warrior lineages-themselves sharply differentiated from the families of captive/mercenary recruits (sebe). This specialization can be attributed to a long history of demographic pressure

on the agricultural land flooded by the Senegal River (Walo) or its tributaries (Fonde) aggravated by unstable cropping results on the rainfed (jery) land. Furthermore, Maghrebian chronicles attest to important trading links with the Kingdom of Tekrur as early as the ninth century A.D. The trans-Saharan, commercial impetus towards economic specialization was facilitated by the simultaneous penetration of Islam into the social fabric of Fouta Toro. The manifestation of Torobe exclusivity seems indistinguishable from the intensity of the Torobe religious commitment.

Thus, one can safely say that it has been ^{some} time since the inhabitants of the Fouta Toro could be described as a homogeneous tribe or even as an ethnic group. The most that can be said is that they are Al Poularen, speakers of the same language: Poular. The French reaction to this seemingly (to them) un-African heterogeneity was to transform the Maghrebian name for the mediaval Kingdom, Tekrur, into a homonomous name Toucouleur (literally, "all colors"), that could at least possess a tribe-like homogeneity of heterogeneity. For analytical purposes the term "Toucouleur" tells more about the mercantile French of the 18th century than it does about the social organizations that have developed in the Fouta Toro.

While each in-marrying group in the Fouta Toro had a practical if not also a symbolic link to a particular economic and/or socio-religious speciality, the degree of mobility in or out of each of the endogamous categories varied widely. In general it can be said there was greater flexibility as the subsistence concerns of any given group moved further away from the river. Those social specializations that interacted to gain a living and/or a surplus

off of the Walo, depending upon the particular "caste" in question, were less flexible than those that arbitrated for control over (less reliable) Fonde production. The Al-Poularen seeking a living almost entirely from the rainfed jery were the freest in this respect. As rainfed millet cultivation can be assumed to have become progressively precarious as fuel-using, goat keeping sedentary populations began to concentrate on the river aggravating the degradation and erosion of the jery land, the only groups that could depend on it for the bulk of their income were cattle owner/managers. The geographical and social mobility of these poular-speaking pastoralists, called, collectively, Fulbe, was so distinctive with respect to the rest of Fouta society, that their model of literation, as it was spread by the pastoral perigrinations of the original, Fouta Toro Fulbe, has been readily adopted (along with the poular/fulbe language) by pastoral specialists across the entirety of West Africa.

These Fulbe can be assumed to have grazed, according to the availability of water, the jery now falling with the project zone, for the entire period referred to here. They may or may not have been joined by more sedentary Al-Poularen as dictated by the success of hand-dug wells in the drainages of the area¹ Poular-speaking farmers, however, could not displace the Soninke farmer settling the river banks upstream from Fouta Toro

1. On the plateau the clay drainages permit, intermittantly, permanent wells while the sand drainages to the east of escarpment only support seasonal seanes.

with the rise, and particularly after the fall, of their Ghana empire to the east during the tenth and eleventh centuries A.D. The Soninke Kingdom of Bundu was centered on this river settlement from the time of Ghana's collapse to the 18th century growth of downstream trade with the Atlantic powers. As expert rainfed millet farmers, the Soninke must have made much more effective use of the upstream land, than could have any farmers from Fouta Toro downstream, as much less of it was flooded Walo or Fonde. While they could farm the jery near the river, the difficulty of establishing wells into the interior (i.e., the Project zone) left that jery free for Fulbe use. The configuration of baobab ² clusters, and the growth pattern of their branches, suggests periods of erratic and intermittant settlement - a pattern that continues today.

Then, as now, it can be assumed that sedentarisation in the project zone could not be contemplated without ample amounts of cattle to provide nutritional support. Hence, poular-speakers with their linguistic, if not social, links to Fulbe pastoralists were more likely than the crop-oriented Soninke to risk settlement into the interior. Even so, if recent history is any indication, powerful politico-religious factors seemed to have also stimulated a retreat to the interior.

2. These trees have to be planted with human help, and their leaf production (for condiments) is accentuated by almost total pruning of their branches. Hence, the history of their use, and the settlement around them, can be read from the configuration of their branches.

At approximately the time (1700) that French commercial contacts with the Fouta Toro began, Torobe sectarians, of the Tijaniyya sufi brotherhood, affected a series of retreats to the precarious wells of the Bundu jery. The wells held, and it was not long before the Sy (sidibe) clan of Torobe took over, by means of a holy war, the Bundu Kingdom and its tax collecting apparatus.

With the return of El Hadj Omar from Mecca to the Fouta Toro in the early 19th century, and the consequent diffusion of Tijaniyya sectarianism there, the premises of the Tijaniyya rule of the Bundu area were absorbed into a wider reformist movement, spreading, both as a holy war and a massive migration, away from the French towards the Fouta Djallon (Guinea) initially, and then Mali.

The Project Villages

The Al Poularen left behind in the project zone by this last pre-colonial convulsion, seemed to have turned inward. It is impossible to say whether this was a result or a cause (or both) of their decision to remain behind. In any case, their Tijaniyya fervor seems to have become less manifest as simultaneously has their prosperity. Left behind with their well-fed, if not always well-watered herds, and their precarious millet production, they at least can be said to have escaped some of the more painful convulsions of the colonial period. This is evident in the relaxed and optimistic fashion in which they receive government personnel.

What organizational resources has this particular history left with the target population of this project?

First of all, the links to the land are over-shadowed by a politico-religious agenda relating to a caste-like ranking of lineages going on with relatives in the Fouta Toro, and the memory of rules (over the Sonninke) in Bundu itself. This opportunism has already facilitated the enthusiasm of this population for the project-particularly as this opportunism finds its economic expression as does the project, in cattle production.

The details of cattle management by this population relate even more intimately to this settlement history. On account of historical, linguistic, and political links to the Fulbe of Fouta Toro, the problem of finding reliable herding labor during the farming season (a problem that, increasingly, as the hiring relationship becomes monetized, frustrates cattle owning sedentary farmers elsewhere in the Sahel) does not arise. The degree to which the farming population gets involved with even the farming season herding of its own cattle can be linked to the caste identity of the compound concerned. For example, the freer nobility of Niya and Gonade play a greater role in managing their own cattle alongside and in association with neighbors of more recent Fouta Toro Fulbe origin, than do the captive categories of Mbaniou Njakone, and Toro Mbolo or the casted occupational groups of Toulekeddi, Boulel and Jare Mabobe (mabo: weaver). The latter, particularly Boulel, have recourse often to a direct wage relation with stranger Fulbe from the

Ferlo, than to a more multi faceted, feudal employment relation born of a long standing association with Fulbe families of Fouta Toro.

Institutional Relationships

The tone, then, is one of unusual sociological and political predisposition towards a project defined within strict cattle producing parameters. Unfortunately, as was noted by all evaluators, an organizational dialogue led by the agents of Promotion Humaine (too few of whom speak Poular in any case) has preceded any technical dialogue (presumably to be initiated with livestock specialists) about cattle production. However appropriate this format may be elsewhere in rural Senegal (perhaps with the nucleated corporate villages of the peanut basin), it has not, according to the ENEA beneficiary survey, made much sense to the settlers in and around the project perimeters. Whether religious or economic, their reasons for settling where they did were opportunistic: to be justified in terms of gains in politico-religious position and livestock. As the history of settlement and resettlement in this area indicates, the solidarity and stability of the community or the localized lineage has never been, as with so many millet farmers elsewhere in the Sahel, an end in itself nor, with the uncertain water table on and around this plateau, could it have ever been.

Even if it could revise its "animation rurale" approach to suit these historical particulars, Promotion Humaine can only be seen as having a very secondary role to play. The inhabitants of the project area have made it quite clear to a steady stream of

"enquêteurs" that they prefer to consult with outsiders on questions of livestock and range production rather than on issues of socio-political organization. If there is more milk to be produced by a mineral supplement program for cows, they will take care of the organization of that surplus milk once it is in fact, produced. It would be idle to orient a "cellule villageoise" in such a direction, if ever, before the additional milk began flowing.

Livestock Bureaucracy and Range Tenure

There are aspects, of this social history that are directly related to the development of any implementation plan for this project. They involve the articulation of the project administration with the producers at 4 main junctures:

- a. The tendency to extend a technical dialogue into other sectors giving the project impact a layering of community development interventions;
- b. The extension of animal health and nutrition supplement support;
- c. The collection of agrostological and production systems information and its organization into an applicable range management plan; and
- d. The application of administrative pressure to assist producer groups identified in the range management plan to implement that plan by controlling the movement of their own and outsiders' cattle over that range.

1. Community Development:

The intersectorial objectives that have been added onto the livestock production framework of this project with the Promotion Humaine amendment are unquestionably worthy objectives. But they have proven unimplementable not only (a) because of the lack of fit between the Promotion Humaine methodology and the rest of the project but also, (b) because of the inappropriateness of that methodology to the sociology of the project zone.

a. This series of administrative and methodological contradictions between Promotion Humaine and the Elevage technical plans on the project were discussed at length in the April Joint Assessment Evaluation. Whatever the importance of Promotion Humaine's "Animation Rurale" for alerting the population to the project in the earlier years, by the time of that evaluation their intersectorial rapport with the population appeared to be overshadowing, even swamping, the ability, or willingness, of the elevage technicians to extend and deliver some of the more basic inputs on which the project was based.

b. This contradiction has proved to be particularly unfortunate as much of the population is settled where it is not prudent to establish self sufficient farming communities in perpetuity (the water table has precluded such an objective in any case) but to pursue cattle

production. Millet, and more sporadically sorghum, are grown when and where possible, but only to feed the cattle producers, and never for sale. To take advantage of the abundant forage in this area, particularly on the plateau, families without cattle are known to have left the area. The establishment of a more corporate community based on cereal grain production is better pursued elsewhere. Therefore, human health and nutrition interventions which precede any support for the real basis of human health, nutrition, and income the basic reason for a human presence in the zone in the first place, livestock, have been confusing and ineffective. With more income from their livestock, the population has shown that they will purchase health and nutritional inputs that go far beyond what any changing of consciousness, through "animation" and "formation" alone could bring. With that income, some sort of extension and education, although not necessarily based on Promotion Humaine's assumption, might be more effective.

2. Livestock Extension Services:

On account of the determinative role of cattle in the settlement history and economic adaptation of the population in the project zone, they are most receptive to outside intervention involving those cattle. The corporate and organizational identity of their (relatively small) villages are of secondary interest. It should be remembered that the opposite is true of villages in the millet belt. But the sociological uniqueness of the handful of hamlets in this plateau society should not be over-estimated. They may be "mixed farmers" in fact but not in orientation or objective. They could all grow millet more easily

elsewhere. They are there for the cattle.

Hence, a dialogue with this population should begin with the subject in which they are most interested. These producers are quick to perceive, as has too often been the case with Promotion Humaine, when an outside agent knows less, or nothing more, than they already know about livestock. Such a perception can engender a passive attitude to any real extension work.

3. Monitoring Plan

For the same reasons, a monitoring plan capable of defining the relevance of pond development for this zone, or anywhere else in the Sahel, must be led, not by animateurs, but by technicians who are at least as aware of the production implications of changes in water availability and range conditions as are the herders themselves.

Only with close contact maintained through this more concrete and specific production agenda will the project get any idea of how herd management decisions are being made. And only when the perception of constraints governing these decisions is known can an applicable range management plan be conceived.

4. Land Tenure

As with the settlement of the project zone, customary land appropriation has been opportunistic. Without a millet - producing objective no proto-animist link between the land and the ancestors has developed. The removal of these settlers to this remote plateau

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has not jeopardized the pursuit of the more individualist - spiritual goals of Islam. The non-individualist demands of a community level social organization have not intervened. The future of the group has not been seen to rest with the community but with the herd. The herd inheriting compound (galle) is a more significant social unit in the economic sphere than the hamlet or the village.

Yet the recent national qualification of the "domaine national" land tenure law places land development responsibility upon "les Communautés Rurales." It is these communautés that legally will have the right to restrict access to the improved range of the project. They are prepared and anxious to do this, maintaining that their villages, or more precisely the relevant cluster of their hamlets (CF, supra) have a sufficient corporate existence to do at least this. They are anxious to know if they can call on the project administration to get the departmental authorities to assist them in doing so. As far as the scope of the "Communautés Rurales" land reform law (see annex for text) is concerned then, the hamlets and their clusters are sufficiently well tied together to be able to bring it to bear around the improved ponds of this project. There is no further "animation rurale" that is necessary to encourage them to do this, only some technical, agrostological precisions as to when it would be most helpful to do so. There the range management planners have to share their preoccupations, procedures, and concerns.

However, for action that did not involve the basis of cattle production, I could not vouch for the predisposition of the concerned compounds to act in concert. Happily, as far as the objectives of this particular project go, this scattered organization does not manifest itself when livestock production goals are common

CF

to all. Few families in the project zone are without cattle. Cattle production is both their individual and collective reason for being there.

BENEFICIARIES ANALYSIS1. Distribution of Benefits

Existing evidence indicates that cattle ownership in the zone is relatively evenly distributed between families, and between women and men in farm-families. The latter, if not the former, is fairly common in West African Sahel. Beneficiaries from increased calf production comprise the entire family, as the income from the sale of extra animals will be used to meet family expenses. If any individual is to benefit more exclusively from the sale, it will be the cattle owner rather than the family head, and the former is as often as not a woman.

It has been noted in the social analysis that the project territory does not offer attractive sites for the installation of crop farming villages, although grain is farmed on a subsistence basis as a secondary economic activity. The soil is not exceptional, and such wells as can be dug are often unreliable. People have tended to settle in this zone only if they have cattle and/or small ruminants. If they lose these they generally leave.

The ponds will enable those already settled in the zone to increase their herd size and income. These 4,000 odd beneficiaries, now among the poorest, can be expected to attain--and perhaps surpass--the level of their neighbors to the east along the river and to the west towards Tambacounda. Until permanent village water becomes more prevalent in the area, it is unlikely that too many new settlers will arrive to partake in the benefits of the ponds.

While the benefits of this project are seen as stemming primarily from livestock production activities, the spread effect of these benefits would include the entire target population. The only explanation for a family settling in this precarious plateau area is to take advantage, directly or indirectly, of the benefits of cattle access to abundant pasture there. Every inhabitant of the project zone derives income in one way or another from cattle production. Although Promotion Humaine has not provided an ownership breakdown of the approximately 20,000 cattle in the zone, indications are that there is an usually equitable distribution among the population.

2. Impact on Beneficiaries

The Joint Evaluation and PP amendment efforts concluded that the pond development component has reduced calf mortality and increased milk production considerably. It is expected that the completion of ten more ponds in the old project zone and along the plateau to the south will approximately double the production, nutritional and reserve benefits already obtained.

Owing to increased rates of calf survival, the procurement of females for reproducing the herd will no longer be a strain on monetary income. This income can be used to purchase consumables or for investment

Increased milk production should be interpreted as having a primarily nutritional impact, as most of the project zone is quite distant from markets at which milk might be sold. Additionally, the increased availability of milk will free up that part of the family income (itself increasing due to livestock sales) taken up with food purchases. Thus money can then be used to purchase other health and nutrition supplements.

3. Relation of Benefits to Social Goals

The primary issue of social feasibility is the range management of pasture areas to be opened to grazing as a result of pond construction. So far, this has not presented a problem. Pond users have been herders from neighboring villages; few migratory herders have yet come to use the area as a result of the new ponds, but when they have come in numbers, the project zone villagers have, of their own initiative, asked project personnel and administrative authorities to assist in removing the intruders.

Legally this has been made possible by Presidential Decree no. 76-1242 of December 31, 1976, releasing the project zone from the "domaine national" land tenure law for purposes of livestock production. This "domaine national" law now has been superseded by the new "gestion des terroirs" decree of last year, instituting legalized land control by registered "communautés rurales."

In the past, the virtual lack of dry season water on the plateau has restricted use of this area by migratory herders to a period of about two months at the beginning of the rainy season when these herds begin their movement north. The migratory herds continue north, spending the rainy season in the northern grazing areas. In the early dry season immediately following the cereal harvest, migratory herds will spend a period of time near their villages to graze crop residues and fertilize the fields. Herds will be kept near the village as long as water and grazing are available in order that the village will have access to milk production of the entire herd.

Accompanied only by young men of the village, the herds then move south, which may bring them back into the project area. Many herders, however, will prefer to stay near the river where they are close to markets for milk because of the higher human population density along the river. The time of this southern movement will vary but usually occurs in January. Project ponds dry up beginning in January, with better ponds retaining water until late March. Thus, the period of time available for use of the project area during the critical dry season by migratory herds (with the assumption that project beneficiaries do not resist) is at most from January to March. At this point, migratory herds would be forced to move to the river for access to permanent water supplies. Thus, the risk of migratory herders ever coming to dominate use of project range area over the local herders is remote. This is especially true as the local population has shown an interest in defending their usage rights in the area.

ANNEX H

ENVIRONMENTAL ASSESSMENT

Range and Livestock Project No. 685-0202

Amendment No. 1

By

Peter H. FREEMAN

Environmental Affairs Officer

Agricultural Development Office

USAID/SENEGAL

June 1981

June 22, 1981

Peter H. FREEMAN, Environmental Affairs Officer

SUBMISSION OF ENVIRONMENTAL ASSESSMENT FOR THE RANGE AND LIVESTOCK
PROJECT AMENDMENT NO. 1.

John BALOS, Chief ADO

Attached please find the environmental assessment of the Range and Livestock Project Amendment No.1.

I have identified a number of actions that can be taken to mitigate some of the observed environmental effects of this project. These are presented as recommendations. All are relatively simple and can be accomplished within the framework of the project amendment. Both the Senegalese and American project staff agree that these actions are possible and needed. Erosion control enclosures around water holes and barriers around forage trees can be constructed with local materials and labor in the same manner as is done to protect small irrigated plots or village woodlots elsewhere in Senegal. Monitoring of sedimentation in water holes and of water levels in wells is easily accomplished with local help, instructed by the project management staff. The recommended mitigating measures are well within the scope and management of the project amendment, and no project re-design is needed.

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Clear: ADO: LJepson

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June 15, 1981

RESUME

Une étude sur les effets sur l'environnement du projet amendé et prorogé d'aménagement des parcours et de développement de l'élevage a été entreprise par le responsable des problèmes d'environnement au niveau de l'USAID/Sénégal pendant trois semaines, de fin mars à début juin. Une semaine fut consacrée à des observations et des entretiens sur le terrain, en compagnie du personnel américain et sénégalais du projet. Des consultations ont eu lieu à Dakar avec des responsables du Gouvernement Sénégalais.

D'une manière générale, les procédures de l'AID en matière d'environnement régissant le processus d'évaluation ont été suivies; toutefois, cette étude peut être davantage considérée comme un contrôle a posteriori des effets sur l'environnement, ayant porté sur quatre années de déroulement du projet, plutôt qu'une projection des effets probables de l'environnement. D'où, l'élaboration de recommandations en matière de gestion du projet en vue d'accroître cet effort.

Conclusions

Les impacts des aménagements de points d'eau sur l'environnement comportent, entre autres, un certain nombre d'aspects liés aux mares artificielles saisonnières, à savoir l'érosion des bordures, le piétinement et le sur-pâturage des zones situées aux abords immédiats des mares. Les chasseurs se servent des mares pour traquer les animaux sauvages à partir de leurs cachettes. Les mares ont réduit la pression exercée sur les pâturages situés aux alentours des points d'eau naturels, ainsi que les risques d'infestation de parasites du bétail en raison de leurs bordures abruptes (qui empêchent les animaux de se tenir près de l'eau et d'y déféquer comme ils le font dans les mares naturelles peu profondes).

L'approfondissement des puits et les nouveaux forages permettront d'attendre les accroissements prévus de têtes de bétail, mais pourront conduire à l'accroissement du piétinement et du sur-pâturage aux abords des puits et, entraîneront probablement un abaissement de la nappe d'eau. L'amélioration de l'approvisionnement en eau devrait avoir des effets bénéfiques pour la santé humaine. Le puisage de l'eau à la main pour l'abreuvement du bétail en saison sèche constituera un handicap indirect pour la taille du cheptel (en raison des contraintes de temps et de main d'oeuvre) et, de ce fait,

contribuera à atteindre l'objectif de gestion du projet, à savoir l'établissement d'un équilibre entre les effectifs du cheptel et les ressources en pâturage.

La croissance du cheptel a été rapide (environ 9% par an en 1978-80). Ceci est apparemment dû aux vaccinations et autres traitements médicaux - notamment contre les parasites. A défaut d'un ralentissement de la croissance du cheptel, la capacité de charge du projet risque d'être dépassée avant son installation réelle et la gestion effective des parcours par les éleveurs, notamment dans les pâturages de saison sèche situés aux abords des points d'eau.

Recommandations

Le grave phénomène d'érosion affectant les abords des mares artificielles et naturelles devrait être freiné au moyen de clôtures posées autour des endroits ravinés et d'ensemencement de graminées et d'herbacés. Les zones détériorées, affectées par l'érosion pourraient également être plantées d'arbres fourragers, notamment celles situées à quelque distance des points d'eau, les plus érodées. Dans les autres zones, le piétinement inévitable et la compaction de la terre aux abords des sources d'eau peuvent être partiellement atténués en encourageant l'arboriculture d'essences fourragères avec de petits bassins d'alimentation et de petits enclos autour de chaque arbre ou de petits taillis.

Il pourrait s'avérer nécessaire de faire effectuer une mission de consultation à Alex Dickie, l'ancien spécialiste des parcours, notamment lorsqu'il aura analysé les données brutes collectées dans les zones de parcours du projet.

Le niveau et la production de la nappe d'eau des puits devraient être contrôlés avec le concours des éleveurs.

Le taux de sédimentation des mares artificielles devrait faire l'objet d'un contrôle, au moyen de poteaux gradués introduits jusqu'au fond de chaque mare.

S U M M A R Y

An environmental assessment of the project amendment extending the Bakel Range and Livestock Project was undertaken by AID/Senegal's Environmental Affairs Officer during three weeks in late March and early June. One week was spent in the project area where observations and interviews were carried out, in the company of the American and Senegalese project staff. In Dakar senior government officials were consulted.

AID environmental procedures which guide the assessment process were in general followed, however the assessment can be viewed more as an environmental post audit, which has reviewed four years of project history, than a projection of possible environmental effects. Recommendations for project management that should enhance the effort were therefore developed.

Findings

The environmental impacts of water development have included a number associated with the dug seasonal ponds, namely erosion around the pond borders, and trampling and over-grazing in the immediate vicinity of the ponds. Hunters use the ponds to ambush wild animals -- including predators of livestock -- from blinds. The ponds have reduced the grazing pressures around natural water holes, and reduced the exposure of cattle to parasite infestation by virtue of their steep sides (which prevent animals from standing and defecating in the water as they do in shallow natural ponds).

The deepening of wells and construction of new wells will accommodate expected increases in livestock populations but may result in further trampling and over-grazing in the vicinity of wells and possibly a lowering of the water table. The improved water supply should have beneficial effects for human health. Hand-drawing of water for dry season stock watering will constitute an indirect limitation on herd size (because of the time and labor constraint) and will thereby help meet the project management objective of balancing animal populations with grazing resources.

Herd growth has been rapid (about 9% per year during 1978-80) apparently in response to the vaccinations and other medical treatments -- especially for parasites. Unless herd growth slows, the risk exists of surpassing the project's carrying capacity before it is objectively established and before range management is effectively practiced by the herders, especially in the dry season range near water holes.

Recommendations

Serious erosion around dug water holes and natural water holes should be arrested by means of fencing gullied portions and seeding with grasses and forbs. Degraded, eroded areas could also be planted to forage trees, in the most seriously degraded (i.e. eroding) areas away from water holes. Elsewhere the inevitable trampling and compaction of earth near water sources can be partially mitigated by encouraging the growth of forage tree species with micro-catchments and small fenced enclosures around individual trees or small copses.

A consultative trip by the former expatriate range specialist, Alex Dickie, may be worthwhile, particularly once he has analyzed the raw data he collected on the project's range resources.

The water level and production of the dug wells should be monitored with the assistance of the herders.

The rate of sedimentation in the water holes should be monitored, by means of graduated posts driven into the bottom of each hole.

A. Introduction

1. Antecedents

This environmental assessment was requested in mid-May, 1981, by Africa Bureau, on the basis of the project's water development component, namely waterholes and wells for stock watering principally.

The original Range and Livestock Project was begun in 1977 and was evaluated in 1980, prior to the design of this project amendment in November, 1980. An Initial Environmental Examination was carried out in the course of this design work, and a negative determination was recommended. Therefore, the present environmental assessment has benefitted from a considerable amount of background documentation: an initial project paper and its accompanying documentation ^{1/}; an evaluation ^{2/}; a designed amendment; and an Initial Environmental Examination (which accompanies the amendment project paper).

2. Methods

The present environmental assessment was undertaken by the Environmental Affairs Officer recently contracted by AID/Senegal, during late May and early June of 1981.

Regulation 16 and recent revisions (22 CFR Part 216) were followed as closely as was practicable. Also, guidance was taken from Environmental Design Considerations for Rural Development Projects (by Harza Engineering for USAID, Washington, D.C. 1980).

^{1/} C.I.D. 1976. Final design report Eastern Senegal Bakel Range Livestock Project. Consortium for International Development. Logan. Utah.

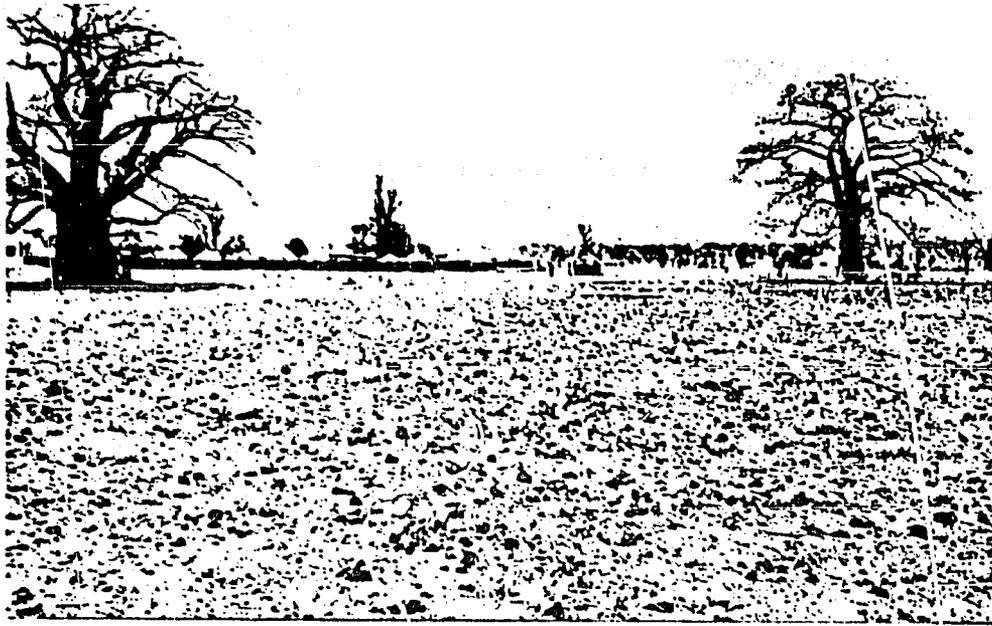
^{2/} USAID/Ministry of Planning and Cooperation of Senegal, 1980. Joint Assessment of U.S. Assistance Programs in Senegal, Annex.

The unusual amount of extant background work on the one hand and the fact that the environmental assessment is for a project initiated four years ago, on the other, lent a unique context to the exercise. Project alternatives had been already considered and rejected on grounds other than environmental in the design work for the original project. The environmental impacts of the project could be for the most part observed in the field, or from records, rather than deduced. The overall development of the project including expected as well as unexpected results could be appreciated. Environmental issues that would otherwise have to be derived through abstract projections could be discussed in concrete terms in the context of actual events. In essence, the environmental assessment was in large part a post audit rather than a projection, with the prospective of deriving lessons from past experience that could be used to manage the extension of the project.

Four days were spent in the project area with the AID project manager and his Senegalese counterparts. Issues were identified and discussed in the field with these people. Project documentation was reviewed in Dakar and the assessment was discussed in interviews held with Mr. Abdoulaye Niang, Project Director for the Government of Senegal, Mr. El Hadji Sene, Directeur, Service des Eaux et Forêts, and Mr. Oumar Welle, Minister for Urban Affairs, Habitat and the Environment. Copies in English of the assessment with a French translation of the summary were circulated to the above-named Senegalese officials.

3. Description of the Project Area

This description is merely a general orientation. Additional environmental, social and economic details are contained in the project paper for the amendment and in the design study for the original project cited earlier (C.I.D., 1976).



*Dry season aspect of fields surrounding
villages, with abundant manure.*



*Heavily trafficked trails near natural
water holes, subject to gully erosion.
Note the relative flatness of the terrain.*

The project area is a low lateritic plateau in Eastern Senegal bordered on the east by a low escarpment of laterite outcrops that marks the watershed of the Senegal River Basin to the east. Soils are predominantly thin, yellow lateritic clays developed over Tertiary sandstones in places covered with relict indurated laterite (or cuirass) occurring as large plates, isolated large blocks or smaller stones and pebbles. Water courses are very shallow and mostly dry but important for their small naturally flooding ponds, and deeper, coarser alluvial sediments in which are dug village wells. Settlements are therefore situated on or very near to water courses.

The amended project will encompass 150,000 hectares of relatively poor brushy range with a tree overstorey. The original project was smaller, with 110,000 hectares.

Fire control due to firebreaks already constructed in the project area is beginning to transform the dry season appearance from one virtually devoid of grass cover to one with an impressive accumulation of dry grass -- up to 2 tons per hectare.

The thin soils over most of the plateau support only annual grasses and forbs; perennial grasses occur only in the deeper sediments of the water courses.

Small villages are surrounded by millet and sorghum fields, heavily dotted with manure at the end of the dry season. Cattle are gathered at night in the fields in readiness for morning watering at the deep wells virtually every village has dug.

The Peul-speaking herders observe traditional grazing areas and it is noteworthy that these are sedentary people who do not practice transhumance or nomadic habits. This is an important social characteristic favoring the project's range management plan.



Firebreak road . Note thick grass on the right side of the road, which has not burned.



The wooded range characteristic of the project area.

B. Environmental Assessment

1. Project Actions and Issues examined

The aspect calling for this assessment is the water development component. However, since water is the limiting factor -- therefore the controlling factor -- to livestock raising and range utilization in the region, these two related aspects were also reviewed in somewhat greater detail than in the Initial Environmental Examination.

Within this context, a number of issues with environmental or natural resources implications were identified through preparatory work in Dakar; additional issues were brought out in the field. The issues were:

* Balancing cattle numbers with range carrying capacity.

This is a principal management goal of the project.

* Erosion around excavated water holes.

* Degradation around permanent wells and the vicinity of water holes, both excavated and natural ponds.

(identified in the original project design).

* The need for controlled burning.

* Wildlife conflicts with herding, and hunting at waterholes.

* Relationship between cattle parasite infestation and pond environment.

These issues are related in various ways to the three project aspects mentioned above.

2. Alternatives to the Project Actions

Two alternatives to the proposed water development actions were considered in this assessment: (1) no additional water development and (2) water development through wells and pumps rather than excavated water holes.

(1) No more water development:

No more water development would leave the project unfinished, in terms of its original design. This would result in greater concentrations around extent water holes than would be the case if all planned seasonal water holes were excavated, i.e. the case of the amendment. The environmental consequences would be locally more intensive grazing patterns and more degradation around water holes than would be the case with the extended project.

(2) Deep Wells:

Deep wells development instead of excavated seasonal water holes was an alternative that was considered in the early design stages of the initial project, and discarded on technical grounds. The depth to the dry season water table in the area is 45 to 50 meters, and rainy season levels are only a few meters higher. It is for this reason that the World Bank excluded the project area from its adjoining livestock project, which employs wells for stock watering.

Deep wells would probably require the installation of pumps, in as much as hand drawing would compete with labor normally dedicated to wet season agricultural tasks. Pumps in turn would increase costs, but more importantly present a water and range management requirement which is presently beyond the capacity of the project personnel and the villagers themselves. They would lead to overstocking of the range, and perhaps the establishment of human settlements on what are the areas most fragile (thinnest) soils.

3. Summary of Environmental Consequences

The summary presented is only for the project as designed and only for water development and related aspects. As stated in the previous section, there are no real alternatives for the project's water development action that are equally feasible.

Table 1 : SUMMARY ENVIRONMENTAL CONSEQUENCES

| <u>Project Action</u> | <u>Environmental Consequences</u> | <u>Comments</u> |
|---|---|--|
| -Seasonal stock ponds | <ul style="list-style-type: none"> -Erosion around edges -Hunters ambush wild animals in the dry season -Reduction in parasite infestation of cattle -Trampling and over-grazing in vicinity of ponds -Reduced grazing pressures around natural water holes and wells. | <ul style="list-style-type: none"> -Fence off more gullied portions -Hyena and jackal population declining. Predation reduced. - Fence off more fragile areas, subject to erosion. Grow trees in degraded areas of heavy traffic. |
| -Deepen wells, or construct new wells | <ul style="list-style-type: none"> -Trampling and over-grazing in vicinity of wells -Lowering of water table possible -Likely improvement in human health | <ul style="list-style-type: none"> -Fence off more fragile areas subject to erosion. grow trees. -Monitor water table -Baseline health data needed |
| -Hand-drawing of water from deep wells to water livestock | <ul style="list-style-type: none"> -Will impose an important labor and time constraint on herd size, and indirectly contribute to limiting grazing pressures. | |
| -Herd growth | <ul style="list-style-type: none"> -Too rapid growth may surpass carrying capacity. | <ul style="list-style-type: none"> -Inventory and establish carrying capacity of different grazing units. |



Water hole in construction. Dimensions are 90 m x 45 m at the surface. Depth is 5 meters. Design capacity is 10,000 m³.



Erosion of loose sediment on upstream edge of recently excavated water hole. An intense early rainstorm in early June partly filled the water hole.

4. Water Resource Development

The ten additional ponds to be excavated will result in fewer than the total number planned in the original project (total of 25) and their location and construction can benefit from experience with the seven ponds already developed.

Soil erosion on the borders of the dug ponds is the most immediate problem and one which can and should be controlled. The ponds are sited in natural water courses whose coarse alluvial sediments erode easily, especially on the upstream lip of the pond. Gully erosion is already a serious problem, especially on ponds numbers 3, 7 and 15 *.

Gullies should be smoothed and seeded and eroded edges of the ponds fenced off (using local materials) to allow a grass and herbaceous cover to re-establish itself. Unless erosion is halted the life of the ponds will be seriously shortened.

Local hunters shoot wild animals from blinds constructed near the water-holes. A variety of wild animals has been identified in the Touleledi portion of the project. This is discussed in greater detail in Section B.7.

The ambushing of game at water holes is not a new practice; blinds are also to be seen on the borders of the natural water holes. The zone is not policed by personnel from the hunting division of Eaux et Forêts, nor do the wild animals enjoy any special protected status in the project zone.

Hunting pressures may be balanced, however, by improvements in the area's habitat. The development of additional water holes by the project could just

* Ponds numbers correspond to proposed numbering system of the original project, rather than sequence of construction or actual quantity of ponds.



Typical village well;
concrete lining extends
to the bottom. The
project will deepen
wells as well as construct
new wells.

Hunting blind
constructed of mud wattle
built in small gully
on the slope at the
water hole.



as easily favor wild animals as cattle, by providing them with more options for watering, as it could operate to their detriment, by virtue of hunting practices. Only if hunting accompanied every new water hole, would the effect of their development be indisputably negative. So far, only two of the seven dug water holes have blinds.

Additional comments on wild animals are made below (B.7).

An unplanned beneficial impact of the new water holes on cattle health with implications for range management, was noted by the project's field chief, Djiby Diaw. The steep sides of the dug holes inhibit the cattle from defecating in the water or standing in it. That behaviour is, however, commonplace in the area's shallow natural ponds, and results in exposure to parasite infestation especially by roundworm and liver fluke, which are identified as principal causes for slow growth and weak animals. The reduced incidence of exposure to these parasites because of the steep-sided new water holes has been a factor in the reduction of parasite infestation in the herds. An unexpected beneficial consequence related to this development has been a growing reluctance by local herders to permit outsiders to graze in the project area, thereby exposing their healthier herds to the diseases of untreated outside herds. This perception motivates the local herders to cooperate with the project objective of limiting access to outside herds, thereby helping to control grazing pressures.

The amended project will deepen eleven wells to 50 meters to ensure the dry season supply.

As the herd grows, more time every day will be devoted at each well to drawing water, and it is possible that even the deepened wells will run dry. This can only be conjectured, however, since well production potentials

in the area have not been measured. As long as water is drawn by hand, well production need not to be high -- probably not more than 5 liters per minute, judging from the rate at which rubber buckets are lowered and raised from depths of 50 meters. Even at this low rate temporary drawdown does occur in some wells. Also villagers report that in the dry season, the water table drops about 2 meters. This is probably a regional lowering rather than a depression cone around the wells given the limited use made of the wells (3 or 4 hours per 24 hours).

In any case, the key role of deep well water in the project area suggests that the wells should be monitored in order to detect changes in water table and production. This can be easily done at no additional expense to the project, by having the herders record water levels at intervals during the dry season. More sophisticated methods such as pumping tests are not necessary, and would have to be interpreted eventually in terms of uses made by herders. Project personnel can keep records of each well, and over time will be able to know more surely the relationship between well production and use.

5. Herd Management and Growth

Two slightly negative consequences for herd management are associated with the temporary encampment of herds in the vicinity of the new water holes. Both lead villagers to request that water holes be closer to villages. First, since milk cows continue to graze with the herds, it becomes a considerable chore to transport milk every day from the camps to the villages. The original project paper had proposed that milk cows be kept near the village proper while the other animals grazed around distant water holes. This change has apparently not yet been successfully introduced or accepted.

The second refers to the exposure of herders and their animals to attacks by predators such as hyenas and jackals in the relatively vulnerable circumstances of temporary camps. This problem is reported to be easing, however. Hunters have killed many of these predators.

In any event the inconvenience of moving the herds to temporary camps, and the associated cost if herders are hired, during the two to three month period when the dug holes provide temporary water, is behind villagers requests to locate new holes closer to villages, in some cases as close as two kilometers. Traditionally villagers have allowed their animals to wander unattended in the brushy range, since they would always return at night either to the natural ponds or the well, both of which are close to the villages. The animals themselves are accustomed to being tethered in fields near villages every night, except during the crop season (approximately July 15 to Oct. 15). To break with this tradition has not proven as easy as was assumed. Although, temporary camps are now in use, project management will have to resist importunings from people for dug holes to be located closer to villages.

Herd growth appears to be rapid. Numbers are most accurately recorded through the annual census associated with the vaccination campaign. The growth of cattle only in the Touleledi portion shows as follows, according to statistics collected by project veterinarians:

| | |
|------|------|
| 1978 | 5616 |
| 1979 | 6157 |
| 1980 | 6695 |

This 9% growth rate is considerably faster than the 2% net growth figure noted by Senegalese technicians during the field visit in early June, 1981. The technicians reported a male/female ratio of 3:7 and a reproduction rate of 54.7%. In the Toulekedé portion sheep and goats--the main source of meat--totalled 2,276 in 1979 and 2,189 in 1980. The 9% herd growth rate figure is suspect. The compounded growth rate in recent years has been 5.5% per year.

The 93,000-hectare Toulekedé portion includes the villages of Boulel, Ndiya, Ndidrone, Gonade, Garalla M. Guiraye, Velingara, Djarre-Maboube, Banicu, Toulekedé, Djarre-Mbolo and Sowol. To date a correlation has not been made between the traditional pastoral units, intended to be used in future range management, and these villages and their herds. At this time it is not possible therefore to make projections of when carrying capacity would be reached. However, the rapid rate of herd growth shown by these figures indicates that range resources for the various pastoral units be inventoried soon and related to resident cattle, sheep and goat populations and their projected growth. More is said on this subject below.

6. The Range Resource

The range resource of the amended project comprises 150,000 hectares, as opposed to the original project's 110,000 hectares. Presently available information on the range resource is very general and inadequate for any but very general estimates of carrying capacity. However, the results of two years of field surveys of range characteristics in the vicinity of natural and dug water holes as well as open range, carried out by the original project's contracted range management specialist, Alex Dickie III, will be the subject of his doctoral dissertation (New Mexico State U.). It is important that project managers keep in touch with Mr. Dickie to benefit from the baseline data he obtained.

Mr. Dickie proposed a range management scheme that appears to be well considered, and which is the basis for the amended project. An important observation made by Mr. Dickie concerns the present balance between livestock and range resources in the Toulekeddi zone:

" It is not yet known how much land is needed to sustain the livestock that the villagers own. Therefore it is not known if the area of Toulekeddi zone is balanced to the needs of the eleven villages it contains" (p.2, Dickie, Alex. 1981. Bakel Range and Livestock Project No. 685-0202 End of Tour Report).

The rapid growth of herds in the Toulekeddi zone, noted in the preceding section, underlines the import of this caveat as to range carrying capacity.

In general, it is estimated by project personnel that 6 hectares can support one animal unit (Unite Betail Tropicale or UBT), that cattle in the area equals 0.7 UBT, and that sheep or goats equal 0.12 UBT. At this rate the 93,000 ha. Toulekeddi zone could hypothetically support about 21,000 head of cattle or three-fold increase $\frac{1}{3}$. Since sheep and goats exert about 5% of the grazing pressure in the Toulekeddi zone, numbers of cattle that could be sustained would be slightly less. In any event, the present 9% growth rate of the cattle population in Toulekeddi zone means that hypothetical carrying capacity would be reached in 12 years.

This rough calculation only serves to underline the urgency of getting on with the project's range management objectives. It is especially important that the range inventories of the various pastoral units be accomplished expeditiously in order to provide a quantitative basis for interpreting the results of range condition surveys. This should be a priority task for the American range advisor who is to be contracted under the amendment.

1/ 93,000 - 5,000 degraded ha ÷ (6) (7) .

The possibility of exceeding the project area's carrying capacity will be determined almost exclusively by the dry season water source, namely the dug, concrete lined wells located in each village. During April to the end of June, there is no other water. Water is drawn by hand or with the assistance of horses from depths of 25 to 50 meters. This time-consuming, laborious task occupies a good portion of every day. In Boulel, for instance it takes about three hours per day to water the 516 head of cattle. The project's water holes will not change this practical constraint on herd size. Until such time as herders learn to balance livestock pressures and range carrying capacity, this constraint should not be removed.

Degradation of the immediate environs (approximately 1/2 kilometer radius) of watering places, is an inevitable consequence of large concentrations of heavy, hooved animals. Although the project's range management plan will shorten the periods of heavy concentrations at the well sites and at the natural water holes, increasing herd sizes will partially nullify this project benefit. Before the project degradation already affected approximately 5,000 hectares in the natural drainage ways of the Touleledi zone, where natural ponds form. Gully erosion is affecting the degraded area between Baniou and Touleledi villages, and causing vehicular traffic to detour around gullies eating into the road bed.

While it is inevitable that trampling and overgrazing in the vicinity of water places will eliminate annual grasses and herbaceous plants, this consequence could be minimized by encouraging the growth of trees such as Acacias and woody shrubs such as Gueira senegalensis. These could be submitted to controlled browsing. Also, degraded areas subject to gully erosion should be fenced off and some form of ground cover re-established. It may be necessary to use the ripper on the project bulldozer to break the ground sufficiently

to encourage penetration of roots and moisture.

7. Wildlife

The project's former range manager called attention to the hunting pressures on the areas' wildlife and listed species he had observed.

Table 2 . Wildlife Observed in the Project Zone

(Source: Dickie. 1981, End of Tour Report)

Lion (sign seen in late dry season)

| | |
|------------------|-----------------------|
| Gazelle | year around |
| Antelope | seasonal |
| Aardvark | year around |
| Warthog | " |
| Jackals | year around, numerous |
| Hyena | year around |
| Small cats | year around |
| Rabbits | |
| Ground squirrels | |
| Red monkeys | |
| Python | year around, numerous |
| Snakes | |
| Mice | |
| Vultures | |
| Owls | |
| Hawks | |

Dickie suggested that monitoring wildlife in the project area as a means of knowing the long term effect of the project .

However, at present in Senegal there is no knowledge of the relationship between wildlife and range condition or quality. In fact, the principal concern related to wildlife and livestock is predation by jackals and hyenas, according to

Mr. El Hadji Sene, head of the Service des Eaux et Forets (which includes the wildlife and game management). There is presently no special program for protecting or managing wildlife populations in the project zone, nor does it appear feasible or reasonable to add wildlife management as a project objective.

Control of brush fires is likely to favor wildlife in the zone, by providing year around cover and grazing. Hunting at water holes could, however, nullify this benefit, at least for resident wildlife. *

8. Health Aspects of Water Development

The IEE noted the beneficial effects to human and animal health that could be expected as a result of the project's water developments. Improvements in animal health have been noted, however human health improvements would only be revealed through a series of appropriately designed surveys. Since improvement of human health through water supply development was not an explicit goal of the project, the corresponding baseline surveys are not justified. Moreover, it can be noted that even if the project has set forth improvement of human health as a purpose, the provision of improved water supply alone would not be sufficient to achieve the goal.

No negative impacts on human health resulting from the project's water development can be expected. The seasonal water holes are far from human settlements and do not provide a habitat for snail vectors of Bilharzia. No negative impacts can be expected from the deepening of existing wells, or the new wells that will be dug.

Senegal has well formulated relatively strict hunting laws. The project director has assured the USAID that all project agents work to apply these laws. The immediate enforcing responsibility lies with agents of Eaux et Forets. The project project has two positions for these agents who will be equipped with Mopeds. Also, the adult literacy classes will include preservation of wildlife among the very practical courses taught in the classroom.

C. Recommendations

Various actions to avoid or minimize negative environmental consequences were mentioned in the foregoing section. Here they are expanded. These recommendations are well within the scope and design of the project amendment. They are basically management solutions which respond to observed results of the project and all were discussed with project personnel in Bakel.

1. Environs of Excavated Waterholes

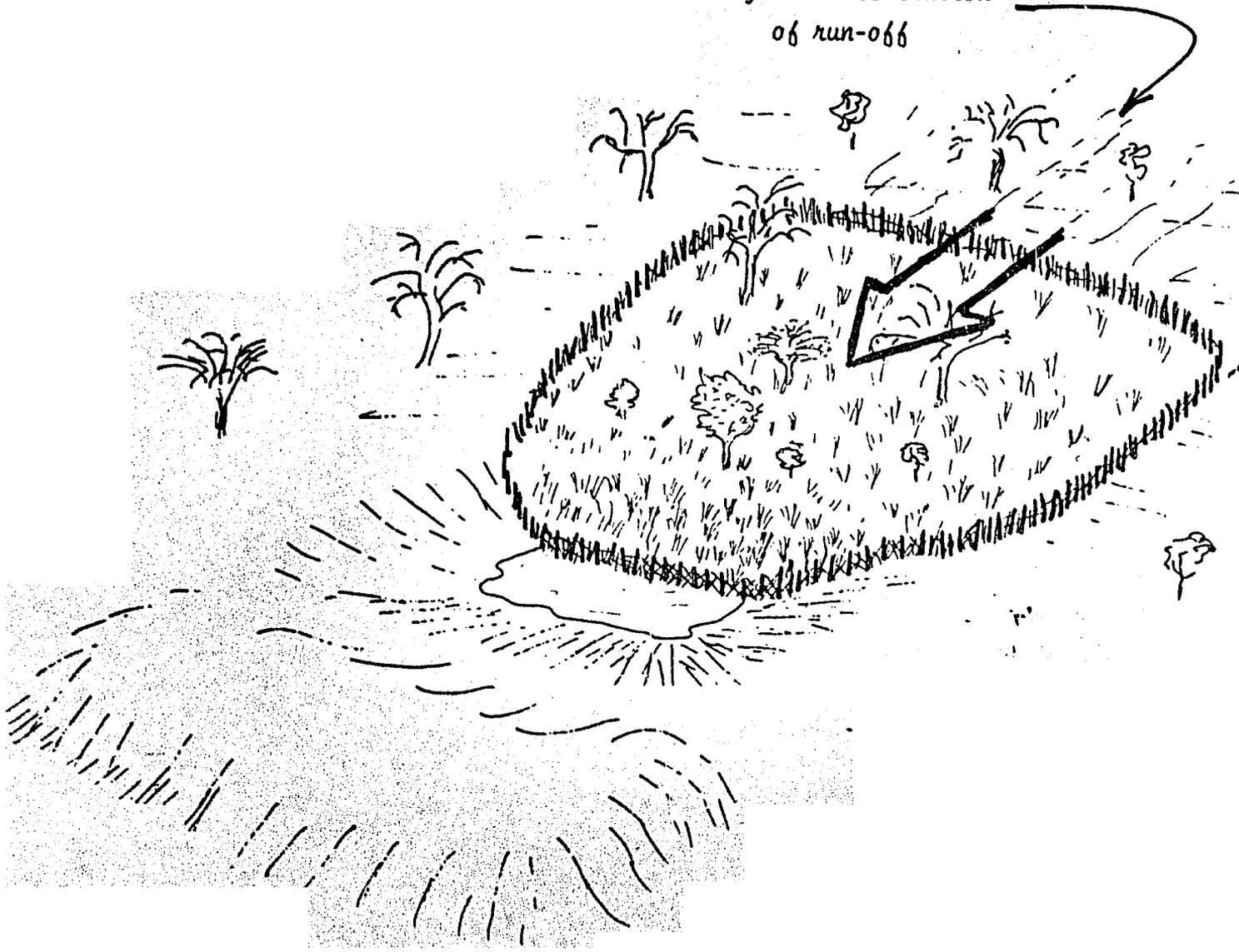
In order to prevent gully erosion on the border of the waterholes, especially headward gully erosion of the relatively loose sediments on the upstream side, the susceptible surfaces must be planted to grasses and herbaceous cover. Fences of local materials must be erected to exclude livestock from these areas. It should be possible to re-establish perennial grasses in these areas. The loose sediments of water courses are moist year around at depths of 2 meters or more, and are the only sites in the project that support perennial grasses.

2. Environs of Natural Water Holes (Mare Naturelle)

Soil compaction associated with heavy livestock traffic around natural water holes is an unavoidable phenomenon, that has resulted in bare ground, devoid of grasses or forbs with the effect lessening at distance of several hundred meters from the water holes.

Where animal traffic has led to gully erosion, such areas should be locally fenced off, planted in grasses and bushes in order to arrest erosion, which otherwise will contribute sediments to the water hole. Areas not being eroded have tree growth, and this could be encouraged if not increased, by building small dikes that channel local run-off to copses of trees or individual trees, and by loosening the soil around the trunks to facilitate percolation of the run-off to the root systems. It will probably be necessary to construct fences

Major Concentration
of run-066



Proposed enclosure to protect
upstream border of water holes.
Shape and size of the enclosure
would depend on local topography;
Fence can be constructed from
local trees and brush.

around trees or copses so treated -- similar to those used to protect mango trees -- in order to exclude animal traffic that would compact the soils. Trees or brushy species provided this micro-catchment treatment could be indigenous species valuable for browse or other products, or introduced species such as various Australian acacias with browse value that have been already tried in the project area. In short, these degraded areas could with some effort and management be made to produce browse for feeding to livestock in the dry season. They need not become totally useless. It is worth noting that if too large a total area is excluded from animal traffic in the environs of water holes, a smaller area will receive the same concentration of animals with damaging consequences. This is why micro-catchments seem to be the best solution for encouraging tree growth, as opposed to block plantations.

Plantations of forage species would be the preferred solution, however, for severely degraded areas under active gully erosion, or areas susceptible to gully erosion.

3. Consultation Trip by Alex Dickie

In order to reap the full benefit from Alex Dickie's range vegetation research during 1979/1980, it may be necessary to bring him to Senegal. It is unfortunate that Dickie departed before the return from a study tour in Morocco of the Senegalese range management technician now assigned to the project.

There was no person-to-person exchange of experience as a consequence. As the range management component develops, the desirability of a consultation trip by Mr. Dickie should become evident. Meanwhile Mr. Dickie is working up raw data on the project's range resource as his Ph.d. dissertation at New Mexico State University, in Las Cruces. He should be urged to share interim results of his work with the Bakel project management.

4. Well Monitoring

Given the primacy of the ground water resource in the three month dry season, this resource should be monitored. Simple measurements can be devised that could be made by people in each village and passed on to the project personnel for recording. Parameters should include depth to water table, number of liters drawn per hour (estimated from size of local rubber buckets and time for drawing a bucket full), and length of time for well to fill up to starting level after being drawn dry (or after finishing a standard watering). Measurements could be made once a month, and should capture the increase in water use as herds increase.

5. Sediment Monitoring

The rate of sedimentation in the water holes should be monitored. This can easily be accomplished by driving re-enforcing bars or rot-resistant wood posts in the bottom of each water hole, leaving at least three meters exposed, and painted or clearly marked at 1/10 meter intervals (approximately every 3 inches). Taller markers -- five meters exposed -- could serve the additional purpose of registering water levels and permitting more precise knowledge of water available at the end of the rainy season.

TECHNICAL ANALYSISI. Land Resources BaseA. Location

Situated on the eastern edge of the Continental Terminal, between 14° and 15° North latitude and 12° and 13° West longitude, the project zone is extremely flat, broken only by relatively shallow drainages running to the southwest, and by the outcroppings of the Continental Terminal which forms an escarpment as the eastern boundary of the Zone. The main access road into the area runs along the northwest side of the zone and connects Bakel with Goudiry to the south.

B. Climatological Description of the Area

(CID Report, 1975)

Rainfall records for Bakel for the years 1919-1974 were obtained from the ASECNA office in Dakar. These records were the only meteorological records available from the Bakel area. Rainfall amounts by month and number of days receiving precipitation were recorded. The average annual precipitation for the Bakel station is 502.9 mm (19.8 inches) for the 56 year period. The concentration of precipitation generally occurs during the months of June, July, August, September, and October while the beginning and ending periods vary from one year to the next. During this period, 5 1/2 to 21 days have a measurable amount of rain. The minimum amount for a given year was 233.5 mm (9.2 inches) in 1921, while the maximum rainfall occurred in 1967 (902.5 mm or 35.5 inches)

The chance that the average rainfall will be exceeded is 52 percent based on past records. The chance that less than 15 inches (381 mm) of rain will occur during a given year is 14.3 percent, while the chance of receiving 10 inches or less (254 mm) is 3.6 percent.

C. Soils

Four basic soils are present in the Touleledi Zone (Maignien, 1965).

These are:

1. Non-climatic undeveloped erosion mineral soils which are lithic with ferruginous armor coatings on clayey sandstones. They are found in the NW corner of the zone and are useful as grazing land.
2. Non-climatic undeveloped erosion mineral soils which are regolithic and found on clayey sandstone. They are also found in the NW corner of the zone but are thought to be practically unusable.
3. Poorly developed erosion soils which are lithic gravelly soils on ferruginous coatings over clayey sandstones. Found over the entire zone except in the NW corner and the drainage ways, they are good for cattle grazing but unsuitable for cultivation.
4. Sesquioxide leached tropical ferruginous soils with ferruginous spots and concretions just below the clayey accumulation horizon on sandy clayey sandstones. Only found on the drainage ways, they are widely used for cultivation and the only soils so suited in the entire zone.

D. Controlling Geologic Conditions for Water

The geology of the area controls the movement of the people and the amount of water, both surface and subsurface, that is available for their use.

The geology consists of old iron lateritic areas which form continuous surface outcroppings along the rim that are largely impermeable to water. These outcrops were formed on the old primary terrain.

Overlying these areas are the most recent sediments of the continental terminal formation which are much younger in age. This material occupies most of the western part of the zone. It is in these sediments that deep sands may be encountered for deep wells. These are sands that have produced deep wells in other areas, but they

have not been tested in this zone. These sediments slope gently to the southwest and all of the major stream patterns are cut into these sediments.

The wells in the area are found largely in the shallow sands. How deep these sediments are in this area has not been determined as none of the wells are over 47 meters deep. Indications from a large scale hydrologic map of Senegal indicate they may be 100-200 feet thick before crystalline rocks are encountered.

Table I shows information on several wells in the existing zone. It is quite apparent that the old wells are becoming less productive. Where these older wells occur villages related several situations where the bottom cement was breaking up which allows sand to filter into the well, thus reducing the amount of water that can be recovered. Where these conditions exist it will only be a matter of time until the well will not yield enough water to supply the people's needs and will be abandoned.

The wells in this area are located in what is called the continental terminal formation sands. At the depth where water is encountered for the dug wells, it is questionable if they are tapping a high water yielding sand. It appears it is largely surface seepage. No wells deeper than 47 meters were measured. It is quite possible that deeper water bearing sands could be located by deeper drilling. Before this is recommended, test holes should be made to determine if there are water bearing sands and the depth of these higher producing water strata.

Table 1. Villages Wells in Toulekedé Area

| Village | No. Wells | Estimated Depth Meters | Dry or Seasonal | Year-long | Temp. | Condition of Casing | General Conditions and Comments |
|-----------|-----------|------------------------|-----------------|-----------------------|-------|-------------------------------|---|
| Toulekedé | 1 | 30-40 | | for people | | Good all way | Well in good condition. Can draw water 1-3 hours and wait 5-6 hrs before they can draw water again. |
| Boniel | 1 | 20-30 | Old dry | - | - | Broken Do not use | Abandoned--not had water for ten years |
| Boniel | 1 | 40 | | for people dry season | - | Breaking at bottom | Can draw well dry in 1 hr. Have to wait 4 hrs to draw water again. Well 20 yrs old. Cannot deepen. |
| Néla | 1 | 40 | | for people | 30° | Not cased. Breaking at bottom | Aug 1957. Had to repair 2 times times this year. Poor drainage at top of well. Some cattle water year long. |
| Néla | 1 | 20 | | old well | | Not cased | Very old well in bottom of drainage. Wood frame. Surplus water drains into well. |
| Néla | 1 | 40 | | yes | | Fair | Poor drainage around top of well. |
| Néla | 1 | 30 | not used | | | | dry |
| Néla | 1 | 30 | | not used | | poor | Water in bottom but covering so they don't use during rainy season |
| Néla | 1 | 47 | | for people | 28° | good, poor drainage | Well 3 yrs old. Can dry well in 3 hrs. Requires 3-4 hrs before can draw water again. Est. 70 people use well. |

II. Range Management Analysis

(Synthesized from final report of Alex Dickie, 1981).

A. Fire

Fires occur at all different times of the year from the late wet season in September till the beginning of the rains in July. The project should make a continuing effort to document the effect of wildfires on the rangeland and the inhabitants in the project zone. Eventually it should be possible to control wild-fires completely and use fire more as a management tool.

Until that time, preventive burning must be continued, at least in certain areas, and this burning should be done very early in the dry season. At this time this is the the most feasible management strategy for fire use.

B. Water Development:

The ponds constructed to date greatly facilitate livestock production in the area. Grazing distribution, and therefore forage utilization, have been improved during the period from the first rains till the mid dry season. All of the ponds have been incorporated into the existing management system within the first year after their creation. The ponds greatly reduce the work load on those villages because they have shortened the time that water must be pulled from wells for watering stock. At least three ponds watered a large number of animals (3000 plus) that were stationed near them in seasonal out-camps.

As would be expected, the ponds constructed by the project are very popular. For inhabitants of the zone, it is re-assuring to see water on the surface, and a relief not to have to work in pulling it from the ground. Since the first pond was built the project administration has been under pressure from the villagers to further lighten the villagers load by placing some of the new ponds near permanent settlements. This pressure should be resisted.

In order to complement and accelerate the growth of the grazing management procedure, the choice of pond construction sites should be confined to the under-utilized grazing areas away from the villages. Following this guideline the project can be sure to complement a rational, traditional use system.

Improvement of village water supplies where necessary should have a high priority in project implementation. A permanent supply of clean water for human consumption is important to the success of the project. Permanent waters must have sufficient yield to support all of the people and the livestock after out lying seasonal watering points have dried up. Well water development with no power assisted head-works is appropriate in this situation. Because of the difficulty involved in pulling well water by hand, villagers will not be tempted, (encouraged), to utilize the grazing area immediately surrounding their settlement until surface water is no longer available.

C. Vegetation Study:

Range Management for livestock production requires that local vegetation ecology must be thoroughly understood. An intensive field study was conducted in 1979-80 in order to make it possible to monitor the effect of project interventions on the vegetation in the project zone. Although the field work has been completed, the final results of the study are not yet available. Baseline data has been collected, but change can only be registered over time.

D. Management

1. Grazing Plan:

Practically speaking the only way to use the forage in the project zone is by continuous grazing. Livestock having free choice, yearlong, to roam and select annual forage and/or browse from their habitual range as conditions change according to weather and use.

This is the method now employed by all of the villages in the project zone. The only exception being that seasonal out-camps must be maintained at the end of the rains on into the early dry season. The seasonal out-camps are born of the necessity to keep livestock away from cultivated areas once the crops begin to mature. The camps have the added advantage of reducing seasonal grazing pressure on the area immediately surrounding permanent settlements. For example, Tulekedi village maintained its Fete Boowal camp from September 1980 until February 1981. Technically speaking this is a "decision deferment", system based on crop conditions and water availability as opposed to forage conditions.

In general, each out-camp is maintained as long as the water conditions at the seasonal reserve is acceptable. Villagers are always anxious to terminate out-camps because of the hardship they impose on the village. Risk to the health and safety of individuals is significantly increased when they stay outside of their village. Traveling and transporting goods (milk) between camp (s) and a village is a definite strain on the young male villagers. Those aged 10-35 usually occupy the out-camps.

Stocking rate and distribution of animals are the two most important items to be regulated in the future management program of the project zone. Ideally, grazing use around permanent settlements, especially in drainage ways, should be adjusted to favor those areas according to the demands of the current years herbage supply cycle. Specifically, grazing pressure near (within 5 km. of), a village should be minimized as soon as possible in the early growing period. Moving the cattle to out-camps as soon as surface water has been collected, and keeping the animals away from the permanent settlements until February in the mid dry-season is the best way to improve grazing distribution. If this practice is followed, and the stocking rate is not allowed to exceed the carrying capacity of the land, a significant improvement in livestock production will be in effect. The project staff should encourage villagers

to expand on their traditional use system by organizing the creation of seasonal grazing zones within the village pastoral units.

Pastures grazed in the dry season should be treated separately from those grazed in the rainy season.

The use system described above would have the following advantages:

a. Outlying areas would be used 1st, thereby insuring their use by the village (s) concerned.

b. The forage cover around out-camps would be reduced before it becomes dry. This would greatly facilitate the prevention of accidental fires that occur, unavoidably, if camps are not opened before late September.

c. Grazing pressure on the area immediately surrounding the permanent settlements would be reduced. Although sufficient seed production does not appear to be a problem, damage by trampling and general over utilization of preferred forage species is evident near every village. Also, water lost as run-off over barren ground should be a major concern. There is a definite need to retain a portion of the veg. cover to protect the soil against wind and rain induced erosion.

d. Standing hay and preferred browse near the village could be reserved for the time of greatest stress.

e. When old growth is able to survive the dry season, it works like mulching and can have a significant effect on the next year's forage production.

Where use is not excessive during the growing season, pastures can be expected to retain their potential productivity.

2. Pastoral Units:

The traditional use system of the livestock villagers in the project zone has been identified by the project staff. The general location of boundaries delineating the grazing area claimed by each village is known. This information was obtained by field agents from all the serves in the project working together over the last two years.

The units distinguished are as follows:

| <u>Village Name (s)</u> | <u>No. of Hectares Claimed</u> |
|-------------------------------------|--------------------------------|
| 1. Oololdou | 23,200 |
| 2. Toulekeddi | 12,800 |
| 3. Bulel-Ndiyaa-Kelingara-Gonaade | 23,000 |
| 4. Mbanu-Sowal-Njaakon | 10,600 |
| 5. Garalla-Jare Maabube-Jare NDOOIO | 13,450 |
| 6. Escarpment | 64,500 |

The total area equals approximately 1500,000 Hectares. The identification and official recognition of pastoral units is a major step forward by the project. With this advancement the project staff will be better able to coordinate their activities and thereby increase their effectiveness.

III. Livestock Production

Senegal Oriental, site of the project zone, remains the most under exploited region in Senegal for livestock production. Senegal Oriental is one of the higher rainfall areas of Senegal, and livestock production does face insect and disease constraints that are more severe than in other regions. However, between these two regions, the Casamance has a livestock population of one UBT to 6,6 ha. and Senegal Oriental has one UBT to 22,8 hectares. As shown in Table II, health constraints, primarily trypanosomiasis, are more severe in the Casamance than in Senegal Oriental, so it is difficult to argue that livestock production has lagged in Senegal Oriental primarily because of a disease constraint. Rather, it appears that it is a region of low humane population density that has been given in the past a low investment priority because of the limited resources available to Senegal.

This amendment design is based on the premise that the traditional livestock system is relatively efficient, that it will use new resources when made available to expand production, and that expansion of the traditional system with relatively

small modifications is the best way to increase production given the low cattle density and areas of unused range resources.

The zone is inhabited primarily by sedentary Peuls who also farm to produce cereals for family consumption. Area farmed in the existing zone is only 0.7% of the total (about 600 of 90,000 ha. is farmed).

Cattle are primarily the crossbred intermediate type resulting from the N'Dama-Zebu cross which is found in the Sudan zone across West Africa. Cattle are unherded except during the cropping season when out-camps are made away from the villages and millet fields. These out-camps are made at natural water ponds, and now at surface ponds constructed by the project. Cattle movements to and from water and grazing generally do not exceed 5-10 kilometers except during the late dry season when permanent water within the zone is inadequate. During this period (April-June), some cattle are moved to the river for access to permanent water. This movement to the river occurs more generally over a large area so that pasture within reach of the river (15-20 km) is heavily overgrazed. Permanent water for the late dry season within the zone would greatly improve animal nutrition and reduce stress to animals as well the herders during this season.

Herd structures in the area from studies and visual observations during the redesign indicate that there is a relatively wide variation in marketing of mature males (see Table III). The percentage of adult males range from a very small 9.6%, indicating a high level of marketing at a fairly early age, to a high of 30.5% which indicates that village savings are probably being held to some degree in mature steers and bulls. It should be noted that a significant difference in percentage of mature males may be caused by the varying importance of agriculture to the village and the concomittant requirements for farm power in the form of oxen.

Table II - Livestock Distribution by Region of Senegal 1969 and 1980

| Region | Area (ha) | 1969, No. of UBT | 1969 ha/UBT | 1980 No. of UBT | 1980 ha/UBT |
|------------------|--------------|---------------------|----------------|--------------------|----------------|
| Cap V | 55,000 | 10,575 | 5.2 | 11,500 | 4.8 |
| Casam | 2,835,000 | 319,874 | 8.9 | 447,000 | 6.3 |
| Diour | 450,000 | 168,370 | 2.3 | 126,500 | 3.6 |
| Fleuv | 4,412,700 | 747,850 | 5.9 | 527,000 | 8.4 |
| Senegal Oriental | 5,960,200 | 222,450 | 26.8 | 261,000 | 22.8 |
| Sine-Saloum | 2,394,500 | 439,150 | 5.5 | 504,000 | 4.8 |
| Thies | 660,100 | 149,000 | 4.4 | 171,000 | 3.9 |
| Louga | 2,904,700 | 563,700 | 5.2 | 440,000 | 6.6 |
| Total | 19,672,200 | 2,620,969 | 7.5 | 2,486,000 | 7.9 |

TABLE III - HERD COMPOSITION IN THE EXISTING ZONE

| VILLAGES | TOTAL CATTLE | TOTAL FEMALE | | TOTAL MALE | | ADULT ANIMALS | | YOUNG ANIMALS | |
|-------------|--------------|--------------|---------|------------|---------|---------------|--------|---------------|------|
| | | Percent | Percent | FEMALE | Percent | MALE | FEMALE | Percent | MALE |
| BOULEL | 516 | 73,8 | 26,16 | 54,2 | 12,9 | 19,5 | 13,17 | | |
| NZIA | 1044 | 70,8 | 29,1 | 46,2 | 9,6 | 24,6 | 19,4 | | |
| NZINKONE | 468 | 68,8 | 31,1 | 58,7 | 23,07 | 10,04 | 8,11 | | |
| GONADE | 105 | 62,8 | 37,14 | 58,42 | 30,47 | 11,4 | 6,66 | | |
| VELINGARA | 250 | 68,3 | 31,6 | - | - | - | - | | |
| JANG MABOBE | 378 | 72,2 | 27,7 | 61,1 | 20,8 | 11,1 | 6,8 | | |
| MBARION | 795 | 69,6 | 30,3 | 51,19 | 18,8 | 18,4 | 11,4 | | |
| TOULEKEDI | 803 | 69,9 | 30,01 | 59,7 | 20,5 | 10,2 | 9,4 | | |
| SOMOL | 586 | 72,01 | 27,9 | 53,5 | 17,9 | 16,4 | 10,06 | | |
| TGRE MBOLO | 1402 | 69,9 | 50,02 | 55,2 | 19,9 | 16,76 | 10,12 | | |
| TOTAL | | 69,8 | 30,10 | 54,35 | 19,32 | 15,6 | 10,56 | | |

The table also indicates a relatively high level of adult females in the herd implying a conscience production function of the herd on the part of the herder.

Percentage of young males and females shows half again as many females as males. It is doubtful that there is significant sale of young animals. Rather, the requirements for family milk plus periods of severe stress during the year result in an effort on the part of the herder to save female calves at the expense of male calves. This is a good strategy. Additional male calves will be saved only by resolving existing constraints of health and nutrition. Given the options, the herder has retained the possibility for a high level of herd growth.

There are a number of good things to do in herd management. From the view of the herder, some are of doubtful value (dehorning, branding). This amendment has selected a very limited number of interventions that are proven (health services), are scientifically sound (salt and mineral supplementation, primarily phosphorus), or that can be expected to show immediate results of high value the herder (increasing milk availability to the family in the dry season).

The recent evaluation and beneficiary study indicated that delivery of animal health services is a highly appreciated project activity to date. The control of animal disease and delivery of a preventative health package is a prerequisite to improvements in nutrition.

The soils of West Africa are generally deficient in phosphorus. Studies by the World Bank project contiguous to our project zone indicate that this area of Senegal conforms to the general rule. The reported frequency of botulism from cattle eating on carcasses is further indication of the depraved appetite associated with phosphorus deficiency. Studies by the University of Florida in South America show substantial improvement in rebreeding efficiency and yearly calving percentage from correction of phosphorus deficiency.

Concerning the activity to increase milk production in the dry season, the price of milk varies from 70 F CFA per liter in the rainy season to 300 F CFA per liter in the dry season. Most people obviously do without milk in the dry season in spite of the high place it is given in the Senegalese diet. Promotion Humaine indicates an infant mortality rate of 50% in the project zone. Although this must certainly have numerous causes, just as certainly, a major problem is nutrition. Increased milk production in the dry season would provide an immediate and high value result. It can be done reasonably well with native grass hay, a small amount of protein supplement (about 1 kg per day per milk cow) and salt and mineral supplements. This program was implemented on an experimental basis by the project in the 1979 dry season. It is technically sound and does not require the strict economic justification of a small farmer cattle fattening activity. The latter does not appear to be feasible given the lack of by-product feeds in Senegal and the distance between the project zone and the source of these feeds.

IV. Technical Construction Considerations

The construction elements of this amendment are based on the experience gained on the initial five years of field activity. They are limited to ponds, roads, wells and vaccination parks. The technical capability to provide these facilities has now been developed and the lessons learned during the initial stage of the project are providing the base for this amendment.

1. Equipment Utilization

a) Operation

The DSPA has the three basic pieces of heavy equipment required for the desired earth work, namely 2 dozers and a grader. The equipment operators and assistants have learned to operate their equipment at the desired efficiency. Yet, past experience has demonstrated that close supervision is mandatory to obtain the consistent work output that the equipment is capable of providing. Thus, this amendment provides for a heavy equipment supervisor to be located at the site a

b) Maintenance

The average utilization of the project equipment is less than 30% of a comparable machine operating in the U.S. One of major reasons for this excessive down time has been the absence of prompt adequate maintenance. To overcome this bottleneck a maintenance contract will be entered into with the local Caterpillar agent to provide regular maintenance. Operators and the project mechanics will only be responsible for first and second echelon maintenance.

2. Ponds

A minimum of 10 ponds will be constructed during the project. Their exact location will be determined by the Water Development Engineer based on the range/hydrology survey that will be performed during the coming rainy season. The typical pond will be based on those successfully constructed earlier, having the configuration shown on the attached drawing. The project equipment operators having built seven similar ponds are now very adept in this kind of construction. The ponds are located in natural drainage area and collect the surface water run-off. Where necessary, collection dikes are constructed to insure impoundment. The location and length of the dikes are also based on the hydrological study of the individual basin.

3. Access Roads/Firebreaks

Approximately 60 km of roads will be constructed under the project with the major portion running north/south and connecting the 11 villages from Sano Youpé to Fété Golonbi. Given the fact that no major drainage problems exist along this escarpment, the road will provide virtually year-round access for these villagers.

The roads will be built to the same standards and with the same personnel of the initial project; namely, a 10-meter clearing with a seven meter roadway. The roadway will follow equal contours to the maximum extent possible because there will be no drainage structures provided. The road will be constructed with the site material since no surfacing material will be provided.

2. Ponds

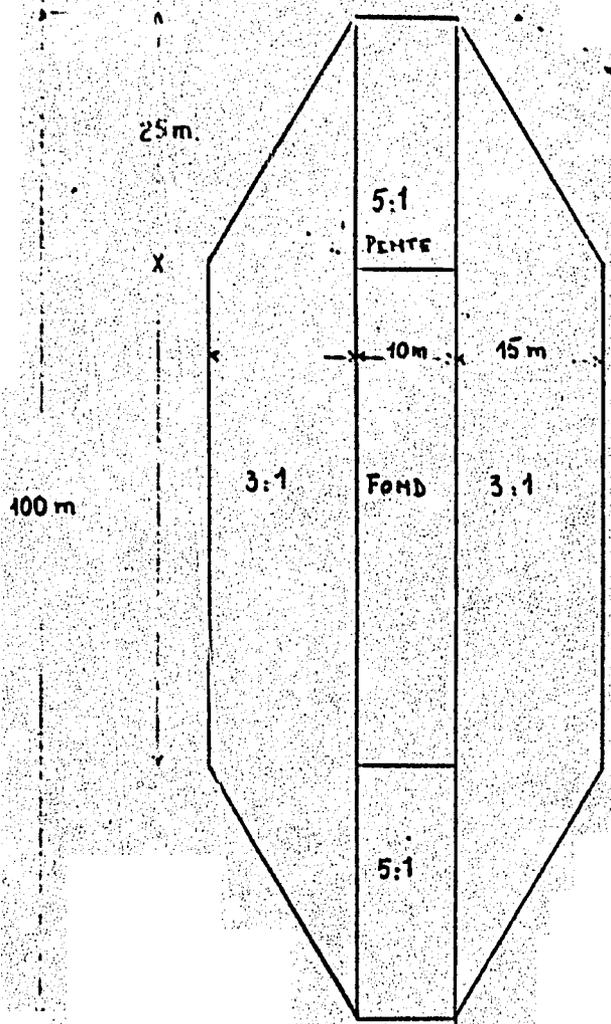
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3. Access Roads/Firebreaks

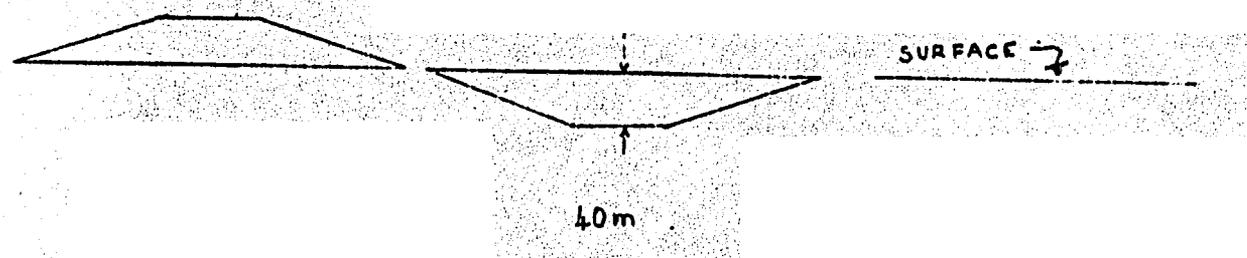
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10
Plan View
VUE DE DESSUS



X - SECTION



5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual fund sources: Development Assistance (with a subcategory for criteria applicable only to loans); and Economic Support Fund.

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

A. GENERAL CRITERIA FOR PROJECT

1. FY 79 App. Act Unnumbered; FAA Sec. 653 (b); Sec. 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that figure)?

Yes. See attached PP Amendment

2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

N/A

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?

N/A

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?

Yes. Attached

6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.

No

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

Assistance to small, private livestock herders with strong community affiliations will contribute toward these goals.

8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

U.S private sector goods and services will be utilized.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

The GOS is incurring substantial recurrent costs in support of this project.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?

No

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

Yes

12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?

N/A

1. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

2. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained

This project is totally oriented toward helping the poor help themselves, men and women alike.

B.1.a.

basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105, 106, 107.
Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

Sahel Development Fund.

(1) [103] for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, is full account taken of needs of small farmers;

(2) [104] for population planning under sec. 104(b) or health under sec. 104(c); if so, extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems and other modes of community research.

(3) [105] for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

(4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

(i) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

(ii) to help alleviate energy problems;

(iii) research into, and evaluation of, economic development processes and techniques;

(iv) reconstruction after natural or manmade disaster;

B.1.b.(4).

(v) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(vi) for programs of urban development especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

c. [107] Is appropriate effort placed on use of appropriate technology?

Yes See attached PP Amendment.

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

N/A to SH

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to the Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

N/A to SH

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.

The Program as described in the attached PP Amendment does these things.

g. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic growth?

Clearly.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.

N/A

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

N/A

B.

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102? N/A

b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities? N/A

Mission Director's 611(e) CertificationI. Project Data:

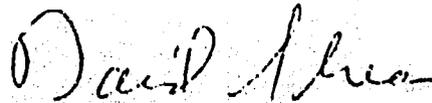
| | |
|---------------------|--|
| A. Country: | Senegal |
| B. Project: | National Range and Livestock- Amendment |
| C. Funding: | \$1.6 million - Amendment \$4.725 million - Total |
| D. Life of Project: | 3 years - Amendment 9 years - Total |

II. Justification:

During the course of implementation of the project being amended, it has been clear both that the need for assistance to the livestock sector of Sénégal Oriental is great and that the specific interventions being continued and expanded pursuant to this amendment are effective in meeting that need. Similarly, not only the project beneficiaries, but also the Government of Senegal have demonstrated both their willingness and their ability to assist in the AID-financed project and utilize effectively the inputs supplied by AID, the GOS and the project beneficiaries. The continued willingness and ability of the GOS and the people involved to continue the beneficial utilization of the assistance to be furnished pursuant to this PP Amendment has been amply demonstrated.

III. Certification:

As the principal officer of the Agency for International Development in Senegal, I affirm that, in my judgment, Senegal has both the financial capability and the human resources to effectively maintain and utilize the goods and services being provided by the National Range and Livestock Project.



David Shear
Director
USAID/Senegal

A. Project Background and objectives:

The project, originally approved in 1974 and operational in the field since 1977, is being extended for an additional three years. The project site is located in the extreme eastern part of Senegal near Bakel in an area underutilized for livestock production due to inadequate water supplies. The zone is inhabited by sedentary Toucouleur herders who in the past were forced to transhum with their herds 20-30 kilometers to the Senegal river for access to a permanent water supply during the dry season.

The project objective is to provide managed, year around grazing for an estimated 25,000 tropical bovin units (UBT) in a project area of about 150,000 hectares, to increase livestock production parameters and to collect technical and economic information to permit informed decisions concerning potential project replicability. Physical infrastructure including buildings, surface water ponds, several wells, vaccination parks, and access roads/firebreaks have largely been completed in an initial area of 90,000 hectares. Range improvements are to be completed over the expanded zone, and range management, livestock production and marketing activities during the project extension is technical and socio-economic data collection to determine AID inputs into the project are comprised of technical assistance, construction of range improvements (primarily temporary and permanent water supplies and access roads) commodities and training.

B. Scope of Work and Level of effort

Technical assistance will be provided to the project for achievement of project objectives as described above. Assistance will be concentrated in specific activities of ground and surface water development planning, implementation of surface water development plans; range management planning, implementation and monitoring; and data collection design and implementation in range resources trends, utilization, household animal protein consumption trends, and economic impact of the project at the herder level.

The level of effort required is for 72 person months of long term and 9 months of short term technical assistance as follows:

| | |
|--|-----------|
| - Range Manager | 24 months |
| - Soil Conservation Engineer/Heavy Equipment Operations supervisor | 24 months |
| - Economist or economic anthropologist | 24 months |
| - Geologist or Hydro-Geologist | 2 months |
| - Sociologist | 1 month |
| - Data Collection Design and Supervisory Time | 6 months |

1. Range Manager Advisor

a. Qualifications: Minimum B.S. degree in range management, three years field experience of M.S. degree and 1 year of field experience. Conversational French, S-2.

b. Responsibilities:

The range management advisor, with the assistance of his GOS counterpart will be responsible for supervision of the project range management program. In this capacity he will create a management situation in which the following activities complement each other :=

1. Water availability and use
2. Forage production and utilization
3. Fire suppression and seasonal control burning
4. Local and transhumant herder inter-relationships
5. Herder and project personnel work efforts.

The advisor and his counterpart will develop and implement the grazing management system, define boundaries of grazing blocks in cooperation with village leaders, map vegetation types, determine forage production and carrying capacities, and develop land use plans.

The specialist will maintain a continuous record on the status of the five factors given above on a quarterly basis to provide base line data and trends. This information will be shared with project personnel and herders in an effort to reach a common understanding of range resource trends and carrying capacity.

The specialist will work with the soil conservation advisor, geologist and sociologist to help select surface and permanent water points which will contribute to a sound range use plan. He will assist the soil conservation specialist in location of access roads/firebreaks such that they contribute maximally to the range use plan.

The specialist will assist GOS project personnel in the execution of livestock production activities, organization of livestock herders, project construction, and economic data collection activities.

2. Soil Conservation Advisor/Heavy Equipment Operations Supervisor

a. Qualifications:

The contractor with the appropriate services and technicians of the Government of Senegal will accomplish the following:

(a) Selection, survey, design and layout of livestock water reservoirs within the geographical area of the project

(b) Design and layout of five lanes, boundaries and access roads,

(c) Supervision of the construction listed above,

(d) Monitor operation, maintenance and repair of the project's heavy equipment.

(e) At the beginning of each working year, the contractor will prepare an annual work plan to be approved by the Livestock Project Manager and the GOS Project Director.

(f) From time to time the contractor will provide technical assistance to other GOS USAID funded projects on equipment procurement, equip maintenance, surveying and general engineer services.

3. Economist

a) Qualifications: Graduate student in economics or economic anthropology. If possible, the person should be an African student needing field research for a thesis. French S-2.

b) Responsibilities: The economist, under the direction and guidance of short term senior supervision, will design and implement data collection activities to determine economic impact of the project at the herder or village level. Measurements will concentrate on household animal protein consumption and household income with and without the project and trends over time within the project. He will establish base line information on the extent of in and out migration for the project zone and the importance line information on the relative wealth of various groups within the project such that redistribution effects of the project can be measured over time.

4. Short Term Technical Assistance

The Geologist and Sociologist will participate with the range manager and soil conservation engineer in designing the water development plan for the duration of the project. Surface water points for pond construction will be chosen consistent with technical requirements for construction, water needs for the range management plan, and the desires of village leadership. Geological information on the zone will be reviewed, summarized and a detailed plan leading to adequate development and distribution of permanent water points or bored wells) within the zone will be developed. These advisors will be fielded and the water development plan completed within the first 90 days of the contract.

Also to be completed in the first 90 days of the contract are design protocols for economic and range resource data collection. Senior-supervisory time in the field to monitor data collection and technical progress under the contract is provided under the short-term technical assistance time item.

C. Reporting

Reports will be submitted to USAID (3 copies in English) and the project director (1 copy in English, 3 in French).

a. Initial Reports

Within the first 90 days of the contract, a water development plan and design protocols for data collection will be prepared.

b. Progress Reports

Progress reports will be prepared and submitted on a quarterly basis.

c. Special Reports

Reports on specific activities, subjects, or developments will be prepared as deemed appropriate by the specialist or as requested by the project director.

4/22/81

REF: USAID/Bakel Livestock Project
No. 685-11-120-202
Your letter PML/ADO/81-12 dated March 18, 1981

SUBJECT: Interim Operating funds
for USAID/Bakel Livestock Project
Period 1981-1983

Dear Director:

I hereby enclose the above mentioned Project Amendment and give you my agreement as to the arrangements that it includes.

Annex D of this document concerns the financial and technical implementation plan for the Project for a two-years interim period from June 1981 to June 1983.

It has been prepared on a basis of agreement by Senegal Office for Health and Animal Production (DSPA) and your Agency.

Your assistance in assuring a continuation of the activities of this important development project will be appreciated.

Sincerely yours,

The Ministry of Rural Development

MINISTERE
DU DEVELOPPEMENT RURAL
ET DE L'HYDRAULIQUE

DAKAR 1 F.

Le Ministre du Développement Rural

00685-202

XXXXXXXXXXXXXXXXXXXX

APR 11 1981

Monsieur le Directeur du Bureau régional
de l'U.S.A.I.D.

- D A K A R

Références : Projet Elevage USAID/BAKEL
n° 685.11.120.202.

Votre lettre P.M.L./ADO-81/12 du 18 Mars 1981.

OBJET : Budget interimaire de fonctionnement
du Projet Elevage U.S.A.I.D. Bakel,
période 1981-1983.

Monsieur le Directeur,

Je vous fais parvenir, en retour l'Amendement concer-
nant le Projet sus-visé et vous donne mon Accord quant aux
différentes dispositions qu'il recèle.

L'Annexe D de ce document concerne le programme
d'exécution financière et technique du Projet pour une pé-
riode interimaire de deux ans allant de Juin 1981 à
Juin 1983.

Il a été établi d'accord partie entre la Direction
de la Santé et des Productions animales du Sénégal et vos
Services.

- ADU
- ADP
- ADQ
- ADM
- AMV
- Reg. Con
- APM
- PAL
- PMA
- FFP
- RHO
- Ex. Sec
- Disp
- TRV
- POO
- PSU
- Chron

En vous remerciant de toutes les mesures utiles qu'il vous conviendra de prendre pour une bonne continuation des actions de cet important programme de développement, je vous prie de recevoir Monsieur le Directeur, l'assurance de ma très haute considération.

Ampliatiions :

- M.P.C.

- D.S.P.A.

Le Ministre du Développement rural