SOMALI DEMOCRATIC REPUBLIC

MINISTRY OF JUBA VALLEY DEVELOPMENT

FEDERAL REPUBLIC OF GERMANY

DEUTSCHE GESELLSCHAFT FÜR
TECHNISCHE ZUSAMMENARBEIT (GTZ) GMBH

gtz

MASTERPLAN FOR JUBA VALLEY DEVELOPMENT

ANNEXES 5 - 14

APRIL 1990

AGRAR- UND HYDROTECHNIK GMBH
Beratende Ingenieure · Consulting Engineers · Ingénieurs-Conseils
Essen, Germany

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Abbreviations

AFMET	-	Agricultural Farm Management and Extension Training Project
AHT	-	Agrar- und Hydrotechnik GmbH
CARS	-	Central Agricultural Research Station (Afgoi)
CSBS	-	Commercial and Savings Bank of Somalia
DEO	-	District Extension Officer
EDF	-	European Development Fund
EEC	-	European Economic Community
ETC	-	Extension Training Center
FAO	-	Food and Agriculture Organization of the United Nations
FEA	-	Field Extension Agent
FMETC	-	Farm Management and Extension Training Center
FSR	-	Farming Systems Research
GTZ	-	German Agency for Technical Cooperation
ICRISAT	-	International Crops Research Institute for the Semi-Arid Tropics
IDA	-	International Development Association
ISNAR	-	International Service for National Agricultural Research
M&E	-	Monitoring and Evaluation
MJVD	-	Ministry of National Planning and Juba Valley Development
MoA	-	Ministry of Agriculture
NTC	-	National Technical Committee
NWC	-	National Water Committee
O&M	-	Operation and Maintenance
ONAT	-	Organisazione Nationale Altressi Trattore
REO	-	Regional Extension Officer
SDB	-	Somali Development Bank
SMS	-	Subject Matter Specialist
T&V	-	Training and Visit System
USAID	-	United States Agency for International Development
WUG	-	Water User Group

Local Terms

Der	-	rainy season; mid October to mid December
Deshek	-	natural floodplain depression
Gu	-	rainy season; mid April to mid July
Jilaal	-	dry season; mid December to mid April
Quintal	-	100 kg
Xagai	-	dry season; mid July to mid October

Agricultural Production Support Services

1. Introduction

The present ANNEX for Agricultural Production Support Services has been elaborated as an ANNEX to the Masterplan for Juba Valley Development. The report deals with the following support services in the valley:

- Agricultural Extension
- Applied Agricultural Research
- Irrigation Development Support Services
- Agricultural Credit
- Land Tenure
- Tractor and Machinery Hire Services (ONAT).

The discussion on each individual support service consists basically of two parts; an analysis of the present situation, and the proposed development measures for the future.

The present ANNEX is complementary to ANNEX 4 - Crop Production. ANNEX 4 presents the details of the developments for rainfed, deshek (flood recession) and irrigated farming in the Juba valley, as envisaged in the Masterplan. A major factor of consideration in the future development of crop production in the Development Area is the role of the agricultural production support services.

The strengthening of the presently insufficiently developed production support services in the Juba valley, would assist in creating a framework in which smallholders could be the main carriers of the envisaged increases in agricultural productivity and production, while they would also be the main beneficiaries.

In this context the overall importance of agricultural price policy has to be emphasized; setting the economic framework for the farm families' daily decisions and determining the profitability of their farming operations, it thus is also a crucial factor in achieving the envisaged development of agriculture in the Juba valley. However, since agricultural price policy is an issue at the national level, it is not analyzed in the present ANNEX, which is restricted to those development potentials, constraints and measures which are specific for the Juba valley.

2. Agricultural Extension

2.1 General Situation of the Extension Service in Somalia

The first agricultural advisory service to farmers in Somalia was initiated at Bonka Research Station in 1954 under a joint Italian/Somali Government scheme. This was followed in the 1960s by the establishment of three extension centers in Lower Juba, Janale and Hargeisa. They were mainly concerned with the promotion of cash crops, particularly citrus and bananas and, therefore, had little involvement with the largely subsistence smallholder sector. Through the 1970s, the emphasis in the Government's agricultural development effort was on expanding the irrigation infrastructure. Extension activities per se received limited attention, with the Ministry of Agriculture (MoA) staff effectively forming a body of local rural administrators with limited technical training.

The Agricultural Sector Review of the World Bank in 1981, summarized the reasons for the lack of extension effectiveness in the country as follows:

- few extension agents or demonstrations at the farm level
- insufficient training of extension staff
- inadequate planning and supervision of field activities
- little information available from the Agricultural Research Institute
- non-availability of inputs and credit
- lack of staff motivation.

While the above listed conditions have been improved in particular in the Lower and Middle Shebelli and Bay Regions, for the Juba valley they still present a fairly accurate description of existing constraints.

Against this background of limited extension activity, the Agricultural Farm Management and Extension Training Project (AFMET), was brought into effect in August 1980. The terms of the multi-donor loan agreement (World Bank, African Development Bank, USAID and EEC) were for funding an initial five-year period, with an additional two years reduced operational funding. The main purpose of the project was to strengthen the extension service through:

- a programme of pre-service and in-service training
- the introduction of the Training and Visit Extension System (T&V)
- the development of adaptive research at farm level.

Since the resources allocated to the project would not allow for the simultaneous upgrading of the extension service throughout the entire country it was decided to operate an extension service in eight Regions of the country, but to concentrate field staff and resources in the three most productive Regions, within easy reach of the project headquarters at Afgoi, near Mogadishu. As a result the AFMET project activities were concentrated in the Lower and Middle Shebelli and Bay Regions.

By 1987 the AFMET project deployed 176 Field Extension Agents (FEAs) in eight Agricultural Regions, supported by 7 Regional Extension Officers (REOs), 12 Subject Matter Specialist (SMSs) and 22 District Extension Officers (DEOs). A FEA to Farm Family ratio of 1:800 had been achieved (against a target ratio of 1:400). The standard form of T&V adopted initially had been modified and developed through the life of the project.

Reasons for the modifications were:

- the lack of transport and fuel for the required field work

- the lack of sufficiently detailed recommendations and hence training packages for the main crops.

The T&V system is presently based on a monthly cycle of activities, contrary to the former fortnightly cycle.

The ongoing extension programme is directed at both rainfed and irrigated smallholders, but it would appear that irrigated farmers have somehow benefitted more from the project than dryland farmers. AFMET does not provide extension services to nomadic stock owners. Extension messages have so far concentrated on increasing production of the most important crops in irrigated and rainfed smallholder farming; maize, sorghum, sesame, rice and legumes such as cowpea, mungbean and groundnuts. In the absence of appropriate agricultural recommendations available from the research stations, AFMET staff themselves developed recommendations for these traditional crops. These consisted of a few simple but very effective planting and cultivation measures and the promotion of the use of insecticides. The main recommendations have been:

- proper seed selection and germination tests
- use of improved varieties
- planting in rows at regular plant spacing
- improved plant populations
- early planting
- improved weeding practices
- use of insecticides for stalk borer control.

The evaluation of the AFMET project, carried out by the participating donors in 1985-86, stressed its initial success and its potential for the future. A follow-up project for the further strengthening and consolidation of the AFMET activities was suggested. Upon favourable appraisal the "Second Agricultural Development Project" was formulated, to be financed by the World Bank with cofinancing by the African Development Bank. The Second Project became operational in September 1987.

The objectives and regional orientation of the Second Project are the same as for the first one, but new extension responsibilities have been included. These are:

- livestock development: extension recommendations would include methods for improving the value of crop residues as animal feed and growing forage crops along with food crops

- agro-forestry: farmers would be motivated to grow trees for fuel wood on the periphery of their fields, which would provide shelter belts without adverse effects on normal crop production

- beekeeping, particularly for the Lower and Middle Shebelli Regions

- extension in animal traction, which mainly involves teaching farmers to train animals and use them on their farms.

Essential to this last extension activity is a programme to identify, develop and propagate suitable animal-drawn implements, for which the Second Project has allocated financial support to the Bonka Dryland Research Station.

It is of importance to note that three of the new extension responsibilities (livestock development, agro-forestry and animal traction) have also been identified in the Masterplan as activities which need special attention in the Juba valley.

In Somalia, due to the occupation of men with animal husbandry, women play a vital role in crop production activities. Under the Second Project it is therefore envisaged that the extension programme should also focus its attention on women. The following measures have been envisaged:

- the proportion of women contact farmers will be increased

- each Extension Training Center would have a training officer, preferably a woman, with special responsibilities for women training

- FEA visits would be made at a time at the women convenience

- farm implements, which would reduce the drudgery of women farm labour, would be identified, developed and propagated.

2.2 Present Status of the Extension Service in the Juba Valley

As can be derived from Section 2.1, within the overall extension programme of AFMET, the strengthening of agricultural extension in the Juba valley, which covers the Lower and Middle Juba and Gedo Regions, has been of a lesser priority. As a result the impact of the extension programme in the valley has been limited.

AFMET is presently established in the project area with a Regional Extension Office for the Lower Juba in Yontoy (near Kismayo) and a District Extension Office for the Middle Juba in Jamaame. Bardheere, which comes under the Regional Extension Office for the Gedo Region, has also a District Extension Office. The rehabilitation and expansion of the Extension Training Center (ETC) in Yontoy has been completed in mid 1988. However, it still needs to be furnished and equipped. The present deployment of extension staff in the Juba valley is as follows: Lower Juba Region: 1 REO, 1 DEO and 10 FEA; Middle Juba Region: 1 DEO, 10 FEA; Bardheere District: 1 DEO and 8 FEA. SMSs are not posted in the Juba valley.

In line with the extension activities in other regions of the country, extension recommendations in the Juba valley have so far included subjects such as:

- introduction of a new maize variety (SOLTEC) for irrigated farming
- application of fertilizer
- application of Basudin for the control of stalkworm
- improved plant populations.

Like in other parts of the country the effectiveness of the extension programme is limited by; persistent recurrent budget problems, reducing field staff mobility; lack of appropriate recommendations prepared by the research stations; and the limited availability of production input supplies such as fertilizers and agro-chemicals.

2.3 Proposed Future Development of the Extension Service in the Juba Valley

2.3.1 General Extension Requirements

The present orientation of the AFMET activities, including the new extension responsibilities envisaged under the Second Project, does meet to a considerable extent the needs of agriculture in the Juba valley, as have been identified in the Masterplan. However, due to the anticipated continuation of concentration of extension efforts and resources in the Middle and Lower Shebelli and Bay Regions, the quantitative and qualitative contribution agricultural extension could make to agriculture in the Juba valley would be insufficient to meet the requirements to develop the identified potential of this area.

A brief outline of the scenario for agricultural development in the Juba valley, as projected in ANNEX 4 is presented in Table 2.3/1.

Table 2.3/1 Agricultural Development Scenario for the Juba Valley

Farming System	Present (1988)		1995		2005	
	Acreage (ha)	Farm Families	Acreage (ha)	Farm Families	Acreage (ha)	Farm Families
Rainfed farming (smallholders)	122,500	21,300	143,500	24,000	192,900	32,300
Deshek farming (smallholders)	11,400	5,450	11,400	5,450	-	-
Irrigated farming (large-scale)	9,600	300	7,000(1)	-	7,000	-
Irrigated farming (medium-scale)(2)	3,400	60	3,400	60	5,000	100
Irrigated farming (smallholders)(3)	4,100	1,200	16,600	5,440	38,000	13,200
Total	151,000	28,310	179,900	34,950	242,900	45,600

Note: Families working as hired labour on large- and medium-scale irrigation farms have not been included.

1) Juba Sugar Project.
2) Banana plantations.
3) Including the proposed Homboy Area Development Scheme.

As is obvious from Table 2.3/1, considerable changes are expected to take place in the agricultural structure of the Juba valley, particularly after the Bardheere Dam has become operational. The development of smallholder irrigated agriculture will be accelerated. The present number of 1,200 smallholders is expected to increase to 13,200 by the year 2005. Most of these new irrigated smallholders will have no or only limited experience in irrigated agriculture, and a special extension effort would be required to train and guide them. On the other side, the present system of deshek (flood recession) farming would eventually be impossible in the after-dam situation, and new farming systems would have to be developed and introduced for the lands presently devoted to deshek farming. While the Government of Somalia has already decided to implement the "Saakow Deshek Pilot Project", to guide the transition of traditional deshek farming to a new farming system, considerable extension efforts would be required to guide the deshek farmers successfully through this process of transition.

While the overall national extension programme undertaken by AFMET takes place in agricultural environments where presently no important structural changes, as a result of large-scale projects or other factors, are envisaged, this situation is quite different in the Juba valley. The agricultural development pattern in the Juba valley, particularly after 1995, will be a dynamic one, which would place a far greater demand on agricultural extension support. Even with the envisaged support of the Second Project to AFMET, it will not be able to provide the appropriate extension support to such a dynamic development pattern.

2.3.2 Specific Extension Requirements for the Juba Valley

There appears no reason why the basic structure of the existing AFMET extension service, its general approach or its established extension methodology should be modified. However, the extension programme must also address issues that are specific to the valley, but may not be regarded of major importance elsewhere. The principal issues are presented below, as far as they are not foreseen already in the AFMET approach and programmes under the Second Project. Other issues may well arise during the further development of the Juba valley and need to be addressed when identified.

- Water Management: Dealing with on-farm water management is a relatively new venture for AFMET. Since it will be of major importance in the Juba valley, the extension service should pay special attention to it. Unlike in the Shebelli valley, where irrigation systems have been established for over a century, in the Juba valley water users' groups do not exist and their establishment would need special extension attention in the future.

- SMSs for Special Crops and Soil - Water Management: It appears likely that cotton, fodder and vegetable crops (including onions) will play an increasingly important role in future cropping patterns. At present the specific problems of these crops are not addressed by the extension service, because country-wide they are not important.

- Integration of Crop and Livestock Production: This issue has been identified as particularly relevant for the Juba valley. AFMET is already envisaging extension activities to improve and increase fodder supply to stock, and to introduce animal traction. However, the need for an animal production and health oriented extension service setup, operated within the framework of AFMET, has also been identified.

In addition to the above considerations the following measures are suggested to strengthen the extension service in the Juba valley. These measures should be implemented as soon as possible, since in principle they are independent from the construction of the Bardheere dam.

(1) Increase of Field Extension Staff to the Required Levels

Aiming at a settled farming community of 35,000 families, an extension coverage of 75% and a FEA : Farm Family ratio of 1:700, 38 FEAs would have to be appointed. The ratio of 1:700 is an average for the project area, but differences may occur between the districts. Particularly in the Bardheere District this ratio may be physically impossible to achieve. Farms are much larger than in the Lower Juba and dispersed over vast areas, and therefore adequate ratios have to be established for different areas. In the Middle Juba Region a Regional Extension Office would have to established. Tentatively, staff requirements are expected to develop as shown in Table 2.3/2.

Table 2.3/2 Development Staff Requirements Extension Field Staff

Area	Presently available			Future requirements		
	REO	DEO	FEA	REO	DEO	FEA
Bardheere District	-	1	8	-(*)	1	12
Middle Juba Region	-	1	10	1	2	13
Lower Juba Region	1	1	10	1	2	13

*) REO for Bardheere District is stationed in Gedo Region

Source: Own investigations.

Newly appointed staff will be subject to introduction training at the AFMET - Farm Management and Extension Training Center (FMETC) in Afgoi, as is presently standard practice. At the FMETC regular in-service training programmes are organized for extension managers (DEO/REO), covering such subjects as extension management and methods and specialized subject matter issues. The main focus for the in-service training of FEAs will be through the monthly training sessions. Refresher in-service training will be provided to all FEAs at the beginning of the Gu and Der seasons at the FMETC. This training would comprise three-week courses; including lectures, group discussions, case work and practical field work.

(2) Appointment and Training of SMSs to Cover Main Area Specific Issues

Presently no SMSs are assigned to the Juba valley. The appointment of the following SMSs is envisaged:

Bardheere District :	1 SMS Vegetable Production (i.a. onions)
	1 SMS Soil - Water Management
	1 SMS Grain Crop Production
Middle Juba Region :	1 SMS Vegetable Production
	1 SMS Soil - Water Management
Lower Juba Region :	1 SMS Cotton Production
	1 SMS Soil - Water Management
	1 SMS Livestock/Fodder Production

Suitable candidates for these posts would need to be identified and appointed. Specialized training needs would need to be established and training programmes designed and implemented.

(3) Rehabilitation and Provision of Office Accommodation, Staff Housing, Transport and Equipment

To increase staff motivation and make assignment to (remote) rural areas more attractive, it is proposed to provide adequate housing for the extension staff, since they are mostly located in areas with accommodation difficulties. The construction of the following houses is proposed:

- 2 houses of 100m^2 each for the REOs in Yontoy and Middle Juba
- 8 houses of 75 m^2 each for the SMSs
- 5 houses of 50 m^2 each for the DEOs
- 38 houses for the FEAs.

Houses for REOs, SMSs and DEOs would be a concrete block construction. FEA houses would be located in villages central to each FEA operational area.

The present regional extension office in Yontoy and the district office in Bardheere would need to be rehabilitated, furnished and equipped. In the Middle Juba Region a building of 100 m^2 for the proposed regional extension office would have to be constructed, furnished and equipped. This office would be located in Saakow or Bu'aale. The recently renovated ETC in Yontoy would need to be furnished and equipped. It is suggested that both REO offices are equipped with a mobile communication unit, including slide and movie projectors, video/TV monitor and generator.

REOs, DEOs would need to be provided with vehicles, the SMSs and FEAs with motorcycles. The terms and conditions for allotment of motorcycles would need to be prepared by AFMET.

(4) Staff Training in Soil - Water Management Extension

Extension services in soil-water management practices would merit special attention. It is suggested that upon completion of the training of the 3 proposed SMSs, special training courses for extension staff will be undertaken. It is proposed that short-term consultants will assist in the preparation and implementation of this training activity.

The training courses will provide lectures and practical field work in all technical aspects of soil-water management, but will also cover aspects such as the organization of water users into groups or associations. Four courses of 1 month duration each are proposed, two for extension staff in the Lower Juba and two for the extension staff in the Middle Juba and Bardheere. An outline of the proposed courses is presented in APPENDIX 1.

As part of the training programme field manuals and extension visual aids for use by the extension field staff, will be developed by the SMSs in cooperation with the consultants.

(5) Introduction of an Animal Production and Health Oriented Extension Package in the AFMET Extension Programme

It is suggested that consultant services will be made available to examine the possibility of providing animal production and health oriented extension services within the framework of the AFMET extension service.

After the elaboration of a proposal (in consultation with the Ministry of Livestock) acceptable to AFMET, the proposed livestock extension packages would be introduced in one or two extension districts as a pilot activity, for the duration of about 2 years. Based upon the results of the evaluation of the pilot activity, a proposal would need to be formulated as to the inclusion of animal production and health oriented extension services in the remaining part of the Juba valley. The appointment of one SMS for livestock/fodder production is proposed.

(6) Strengthening of the Research - Extension Linkages

Procedures to ensure that farmers' problems are investigated by researchers and that research results are provided to and used by extension staff would be one of the keys to achieve the immediate objectives of the project.

Therefore linkages between extension staff and the Bardheere, Bonka and Afgoi agricultural research stations would need to be strengthened, particularly through regular contacts between SMSs and researchers. In addition, before each season, Juba valley extension staff would meet in particular with the staff of the proposed Bardheere Research Station to coordinate the seasonal extension timetable, extension recommendations, research staff participation in monthly and special extension staff training. During these seasonal meetings and the training sessions, extension workers would convey problems, on which they require advice, to the participating research staff. If solutions to these problems are not available, consideration should be given to these issues in order to solve the problems in the research programme.

3. Applied Agricultural Research

3.1 The Present Situation of Agricultural Research

Agricultural research is a responsibility of the Ministry of Agriculture (MoA). The agricultural research service is headed by a Director, who is assisted by a Deputy Director. Both are based at MoA in Mogadishu. Under them are the heads of the main three currently functioning research stations in the country: Afgoi, known as the Central Agricultural Research Station (CARS) near Mogadishu; Bonka Dryland Research Station in the Bay Region near Baydhabo, and Aburin, in the North-West Region. This latter is under the administrative control of the North-West Agricultural Development Project, but staffed with research personnel seconded from the main research stream. The work in Aburin focuses on issues pertaining to the North-West and Awdal Regions, which differ substantially from those in the Juba valley and can therefore be disregarded from present analysis. The Bonka station works on the introduction of animal traction to southern Somalia where traditionally oxen and donkeys are only used to haul light carts, but not tillage implements.

CARS in Afgoi is charged to investigate issues pertaining to irrigated agriculture; it is the oldest agricultural research institution in Somalia. The Bonka station has been upgraded recently under the Bay Region Agricultural Development Project, for the special purpose of addressing issues of rainfed farming, specifically those germane to the Bay region. As noted, the introduction of animal traction is considered of major importance, particularly in the rainfed areas, hence Bonka's focus on its development.

However, with the exception of animal traction, both stations used to focus primarily on varietal and crop introductions and trials, which they appear to believe holds the key to sizeable future yield improvements under both rainfed and irrigated conditions. Scant attention used to be paid to other parameters like soil physics, which would help establish the criteria of appropriate land preparation; following from the above, the identifica- tion of suitable tillage implements; and, perhaps equally importantly, no efforts are made to quantify the effects and determine appropriate standards of land levelling pertinent to the different soil types and irrigation stream sizes. However, lately both stations, but in particular the Bonka station, have started to introduce some aspects of farming systems research in research planning and implementation. Both CARS and the Bonka station have established close coordination with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) for technical advice and assistance as well as for training of staff.

Since 1983 the International Service for Agricultural Research (ISNAR) has been working with the Somali Government to assist in the development of the national agricultural research service. Two major reports have been published since then. In November 1983 the report "Development of an Agricultural Research System" was published; this has been a major formative document for the formulation of a programme to strengthen Somalia's agricultural research system. In October 1984 the report "Somalia's Agricultural Research Program" was formulated, which contained an overall outline of the proposed programme and detailed reviews and recommendations for such specific fields as; study of vegetative resources and their productivity, long-term monitoring of range ecology, livestock economics research and training, initial study of livestock productivity and animal health, suggestions for agronomic and farming systems research for field crops, review of maize research and production, review of the sorghum research programme, reconnaissance of irrigation practices and an irrigation water management programme for Somalia.

Many issues covered in the ISNAR reports are also of relevance to the Juba valley, in particular the reviews and recommendations dealing with irrigation practices and the proposed irrigation water management programme. Any professional staff who would be involved in organizing, programming or undertaking agricultural research activities in the Juba valley would certainly have to familiarize themselves with the contents of these reports. The chapter on "Reconnaissance of Irrigation Practices in Somalia", of the ISNAR October 1984 report, has been included integrally in the present report as APPENDIX 2. Although field work for this section was mostly done in the Shebelli area, its findings are most relevant for the Juba valley.

Presently no major agricultural research activities are undertaken in the Juba valley. Near Jilib, in the Lower Juba, an agricultural substation is located since quite some time, but so far this station has not yet produced any research findings or applicable recommendations.

3.2 Proposed Future Development of Agricultural Research for the Juba Valley

To enable agricultural research to make a meaningful contribution to agricultural development in the Juba valley, which at present is mainly oriented towards the provision of subsistence needs, a greater understanding and appreciation of area specific socioeconomic factors influencing the prevailing farming systems in the valley is required. Secondly, as identified in the Masterplan, there is a need to fill the serious gap of available information concerning area specific appropriate soil and water management techniques, which will be increasingly important under the envisaged dynamic development scenario for the Juba valley.

Considerable changes in agricultural development are expected to take place, particularly after the Bardheere dam becomes operational (see Table 2.3/1). The present area under irrigated crop production of 17,000 ha is envisaged to amount to 50,000 ha by 2005, mostly under smallholder agriculture. The pre- sent overall irrigation system efficiency is estimated at about 20%. For the improvement of this low efficiency no area specific information, as e.g. on suitable on-farm water management systems or soil management techniques, such as the appropriate standards of land levelling and tillage practices are available.

Productivity and cropping patterns in rainfed farming are, to a large extent, determined by low soil moisture availability. Soil moisture retention measures would have to be introduced to improve this situation. Presently little is known locally about these techniques or in how far they may be successful in the rainfed crop production areas in and around the Juba valley.

Information on existing crop management systems in the area is incomplete, which hampers the introduction of improved crop management systems, appropriate to prevailing agro-socioeconomic conditions. Additional data gathering and analysis is recommended.

According to the ANNEX 4 - Crop Production, the feasibility of introducing tractor drawn equipment in a large scale (particularly for land preparation) is doubtful. However, the introduction of animal traction appears more promising, particularly for its potential to reduce labour requirements for crop maintenance activities, which are mostly undertaken by women. Work in this field is presently undertaken at the Bonka research station but would need follow-up for local soil condition and for farming systems in the Juba valley.

For approximately 7,000 ha, presently under deshek (flood recession cultivation), farming practices have to be adapted to the after-dam situation, when this system of crop production is no longer feasible in its present form.

After 2005, due to land pressure, soils might be irrigated which at present are not considered for crop production. Little is known about these heavy textured soils in the Juba valley, in particular not how they will behave under irrigated conditions, in view of their low internal drainage capacity and the presence of salts in the subsoil. Specific research efforts on these issues would be required. The Government of Somalia has already decided to establish an agricultural research station in the Juba valley, to deal with the specific research needs of the area. The research station will be established near the rural town of Bardheere, and the tendering procedure for its physical construction and the supply of part of the equipment is presently in progress (November 1988). Actual construction work is scheduled to start in January 1989 and to be completed in March 1990. The construction of the station is financed through a grant of the European Development Fund (EDF); EDF Project no. 4100.038.47.28).

Since for the future agricultural development in the Juba valley emphasis will be on smallholder participation, it is suggested that, to provide the appropriate research support, at the Bardheere Research Station a comprehensive and multidisciplinary research approach is adopted in the design and programming of future research activities. This approach requires a holistic view on farming reality and tries to understand farming within its ecological, cultural, and socioeconomic setting. Based on the information obtained on these parameters, constraints are identified and relevant research is conducted.

Due to the nature of farming systems research (FSR) considerable part of its activities will not be carried out at the research station itself. Therefore, in addition to on-station research, the implementation of an on-farm research programme is suggested. In the FSR approach, on-station research is closely integrated with on-farm studies, and is executed by an interdisciplinary team of scientists ([irrigation] agronomy, agro-economy and sociology/anthropology). Close cooperation with farm families is an essential aspect in on-farm studies. To undertake on-farm research, cooperation with the Somali National University is proposed, particularly in the fields of sociology and anthropology.

Research would primarily be conducted on issues of immediate and practical interest to major groups of farmers. In crop research first priority should be given to work which facilitates the farm families to cover subsistence food requirements and to contribute to national self-sufficiency in basic staple crops.

Due to the importance of crop residues as animal feed, the continued production of these residues would need to be respected in the introduction of adapted cultural practices or cropping patterns.

Research involving the application of inputs such as agro-chemicals and fertilizers would have to take into account their limited availability to farmers and the relation between their cost and farm produce prices.

In addition to the above considerations with regard to the approach of the proposed research programme, the following specific recommendations are presented:

(1) Scope of the Research Programme

Within the research approach as outlined before, it is suggested that the actual research activities would be grouped in relation to the representative soil types of the Juba valley; levee and alluvial soils, heavy textured soils (mostly vertisols) and the soils in the deshek farming systems. In brief these sub-programmes would be as follows:

- Research for Small-Scale Irrigated and Rainfed Farming Systems on Alluvial and Levee Soils:

  It is envisaged that some 45,000 ha of these soils will be brought under irrigation by 2005 (see ANNEX 4 - Crop Production). Irrigated crop production systems appropriate to these soils would need to be investigated. Since these soil types do not occur at the Bardheere Research Station, it is suggested that the station acquires additional land, situated on alluvial and levee soils. Research would concentrate on precision land levelling, appropriate field irrigation systems, amount and timing of irrigation and surface and subsurface drainage. Furthermore such aspects of irrigated crop production as; appropriate tillage methods, balanced use of inputs, such as agro-chemicals, fertilizers and improved seeds would need to be investigated.

  For rainfed farming improved cultural practices would need to be developed. These research needs do not differ much from those identified for heavy textured soils, and will be discussed in the following section.

- Research for Rainfed and Irrigated farming Systems on Heavy Textured Soils:

  Research activities in support of rainfed agriculture would have to be carried out in close collaboration with the Bonka Dryland Agricultural Research Station.

  Particular consideration should be given to the development of water retention measures in order to retain soils moisture, and to measures to improve soil fertility. Further work may be carried out on crop management systems which include rotations, early planting strategies, shallow or deep planting, weed, pest and disease management, and plant densities for the major crops. Planting of trees, for fuel wood and as windbreaks, the introduction of animal traction and the introduction of higher value crops suited to the ecological and economical conditions are additional issues for consideration.

The clay and clay loam soils of the mantled limestone plain in the Juba valley have a restricted potential for irrigated crop production, since natural subsurface drainage is extremely low and sodium and salt contents are high. These soils present the major soil type in the valley and can be used for rice production. However, in the Middle and Upper Juba the cultivation of rice is not envisaged in the Masterplan, due to extremely high evaporation losses of irrigation water. In the Lower Juba about 5,000 ha of these soils will be brought under irrigation, until the 2005.

However, farmers may eventually use and irrigate these soils, when the alluvial and levee soils are all under cultivation. Therefore the behaviour of these soils under irrigated conditions would need to be investigated to avoid their loss for agriculture due to inappropriate water management techniques or other cultural practices. These trials can be undertaken on the soils of the research station itself.

- Research on Deshek Agriculture:

  After the Bardheere dam has been completed, seasonal flooding of the desheks will not occur anymore as at present, and a new farming system will have to be developed in support of these farm families. While the levee soils in the deshek system are usually suitable for irrigated crop production, the potential of the actual deshek soils under future conditions is not yet clear. The Government of Somalia is considering the execution of the Saakow Deshek Pilot Project to prepare and guide the transition of the traditional deshek system to a new farming system, adopted to the after-dam situation. Research necessary to introduce changes in this agricultural pattern would be supported by the Bardheere Research Station, in particular by its soil and plant laboratory.

(2) Staff Requirements

The following requirements for professional staff are envisaged for the implementation of a research programme as outlined above:

- Director of Research Station
- One irrigation and one dryland farming agronomist
- Soil scientist
- Sociologist/Anthropologist
- Chief administrator
- Farm Manager
- Five research assistants
- Three laboratory technicians.

(3) Technical and Financial Assistance to Implement Research Programme

It is most unlikely that Somalia has the resources in manpower and finances to implement the above suggested research programme, or even a more modest programme. While the physical establishment of the Bardheere Research Station is financed by the EEC, financial and technical assistance will have to be sought to support the implementation the research programme.

4. Irrigation Development Support Services

4.1 Present Situation of Irrigation Support Services in Somalia

In Somalia all matters related to the conservation and exploitation of water resources are coordinated by the National Water Committee and the National Technical Committee, which have been in existence since 1971. These bodies include i.a. representatives of the following ministries:

- The Ministry of Mineral and Water Resources, which is responsible for groundwater resources as well as for the urban and rural water supply.

- The Ministry of Industries, which operates two large sugar cane projects, one of which is the Juba Sugar Project.

- The Ministry of Agriculture, which is the major agency responsible for irrigation development in the country, as well as for collecting all hydrological data on the Juba and Shebelli rivers.

- The Ministry of National Planning and Juba Valley Development, which according to Decree Law No. 29 of 1982, is responsible for the "management and proper utilization of the Juba river waters".

Due to the absence of effective water and water related legislation (water is only mentioned in Law no. 13 of 1966 and Law no. 77 of 1972, but these laws have serious inconsistencies and gaps), the resulting lack of mandate and guidelines and the necessary resources, the effectiveness of these bodies is rather limited.

The Ministry of Agriculture (MoA) through its Land and Water Department, is the major agency responsible for irrigation development and irrigation support services in the country. Since the seventies, irrigation development has mainly taken place through large-scale special projects with their own technical staff (e.g. Juba Sugar and the Fanoole and Mogambo schemes in the Juba valley) and personnel from the Land and Water Department has been seconded to these projects to control diversion and delivery of irrigation water. However, this personnel appears rather to serve project objectives than to guide or supervise the implementation of overall irrigation policies, as far as these would be existing.

MoA is represented in each region of the country with an Agricultural Coordinator. Under the control of the Coordinator - who deals with all matters pertaining to agriculture - are several departments, including one which handles land and water matters. A corresponding structure exists at the District level. However the regional and district level departments for land and water matters are presently mainly concerned with issues concerning the Agrarian Reform Law and land registration.

So far MoA's Department of Land and Water Development has not been able to function as an effective irrigation development agency in Somalia. Its main constraints are the lack of (financial) resources, and closely related to this, its inability to recruit and retain irrigation engineers. No irrigation engineers are trained by the Faculty of Engineering or the Faculty of Agriculture in Somalia. As a result engineers are in short supply. Engineers hired by the department usually leave soon, to go to special projects for more remunerative employment.

Support, advice and training to irrigated smallholders on matters such as efficient on-farm water management techniques, operation and maintenance of irrigations systems, etc. is, since 1987, provided by AFMET (Agricultural Farm management, Extension and Training Project) which is responsible for the provision of agricultural extension services to sedentary farmers in Somalia. The AFMET on-farm water management extension activities are at present mainly concentrated in the Lower and Middle Shebelli Regions. Since these activities have been initiated only recently, their impact is not known as yet.

The National Banana Board, through the Banana Development Project, supports the (medium-scale) banana growers in the Lower Shebelli and Lower Juba Region by the provision of infrastructural measures, such as the construction of roads and irrigation works.

4.2 Current or Planned Activities to Strengthen Irrigation Support Services in Somalia

The following activities are presently undertaken or proposed to strengthen the legal framework, technical knowhow and to some extent implementation capacity of irrigation support services in the country, and bear importance in relation to the present project proposal:

- Assistance in the introduction of water legislation. This assistance has been provided under FAO project TCP/SOM/2314, which was preceded by FAO project TCP/SOM/0105. The main objectives of these projects were to draft and finalize a national water resources bill, i.a defining the composition, powers and functions of the National Water Committee, the National Technical Committee and their proposed Executive Secretariat; and subsequent proposals for the support of the establishment of a water rights administration. As a first step, the preparation of a water inventory and a water master plan have been recommended. These projects have been active since 1978, but only since 1984 have some of the proposed activities been implemented; at a slow pace. Difficulties exist in defining future project support and their anticipated outcome.

- The International Service for National Agricultural Research (ISNAR) has been assisting the Government of Somalia since 1983 in the strengthening of Somalia's agricultural research programme. In the October 1984 report; "Somalia's Agricultural Research Programme", ISNAR has presented a number of elaborated recommendations to improve irrigation practices in the country. These include an outline of a proposed water management improvement strategy, to be implemented initially as a pilot project, a proposal for an action research and monitoring programme on water management and an outline of organizational needs to improve water diversion and distribution to farms as well as the irrigation development support services. Under this last outline it is proposed to strengthen the Land and Water Department of MoA; but it would still allow for special projects to cover irrigation related matters, with technical and administrative backstopping from the department. Although ISNAR has prepared several of its proposals in quite some detail, there is presently no indication that any of them will be implemented on a substantive scale in the near future.

- Of particular interest is the Shebelli Water Management Project. This project has been agreed upon for financing between MoA and USAID and is to be initiated during 1988. The envisaged duration of the project is 10 years, with the initial Phase I to be four years. Project objectives are focused on rehabilitation of existing irrigation facilities in the Shebelli area, with strong emphasis on water user involvement in the various project aspects.

  Collection of water charges for both capital cost recovery and for operation and maintenance (O&M) are to be tested in various areas. The project appears extremely relevant for further development and management of the various irrigation forms encountered and envisaged in the Juba valley.

4.3 Present Status of Irrigation Development Support Services in the Juba Valley

As is obvious from Section 4.2, within the absence of a legal context and with limited implementation capacity of the Land and Water Department of MoA, irrigation development support services are practically nonexistent in Somalia. Moreover, since irrigation development in the Shebelli riverine area dates back several centuries while this development has been initiated in the Juba valley relatively recently, those limited resources available to provide irrigation development support have been concentrated in the Lower and Middle Shebelli Regions.

The main irrigation development in the Juba valley took place since the seventies through special large-scale irrigation projects (Juba Sugar, Fanoole and Mogambo). These projects have at present developed about 8,400 ha under irrigation, but command additional areas which allow for future irrigation development. They possess their own technical staff, are assisted by overseas technical assistance personnel and are mainly financed with foreign currency loans. They have developed proper irrigation infrastructure (gravity or sprinkler systems) and an organized operation and maintenance of the system. Personal from MoA's Land and Water Department assigned to these projects operate rather independently from its ministry.

About 3,400 ha are presently under irrigated banana production, mainly by medium-scale banana growers. These producers receive assistance in irrigation development through the National Banana Board.

About 5,300 ha are under smallholder irrigated crop production which takes place in an uncontrolled and unplanned manner. Small-scale pump irrigation is rapidly increasing in the Upper Juba and expands presently into the Saakow and Bu'aale Districts. It is concentrated mainly on levee soils in a narrow strip along the borders of the Juba river. Anyone who owns or has right to use land along the river and purchases a pump, is allowed to pump water from the Juba river, at any season or time convenient to himself. Since nearly all smallholders have their own individual pump and direct access to the river, contrary to developments along the Shebelli river, no water user groups (WUG) have been established in the Juba valley.

In general on-farm water distribution infrastructure and application systems are of a rudimentary nature and not the result of any particular design. Overall irrigation efficiencies for small-scale pump systems are very low, at an estimated 20%. According to the Masterplan, contributing to this low overall efficiency are factors such as:

- lack of information on what type of simple irrigation structures could be used for a better control of water flows
- lack of farmers' knowledge on appropriate field outlay for irrigation, including land levelling requirements
- lack of materials like wood, bamboo or cement, tools and lack of knowledge about their application in irrigation
- lack of farmers' knowledge on when and how much to irrigate.

Extension advice and efficient support to smallholders on matters pertaining to irrigation development and on-farm (soil-)water management has been negligible up to now in the Juba valley.

The representation of MoA in the Juba valley, as far as relevant to land and water matters is as follows (1987, latest available data):

Table 4.3/1 Staffing of MoA's Regional and District Offices in the Juba Valley (1)

Staff	Bardheere District	Saakow District	Bu'aale Region	Jilib District	Jamaame District	Kismayo Region
Regional Agricultural Coordinators	-	-	1	-	-	1
District Agricultural Coordinators	1	1	-	1	1	-
Land and Water Dept.	1	1	2	1	1	1
Meteorological Observer	1	-	-	1	-	1
River Flow Observer	1	-	-	-	-	-

Source: [64].

1) Non-technical staff not included.

Regional and District Coordinators are involved in a variety of duties, being the de facto representatives of MoA in their area of operation. Presently staff of the Land and Water Department, at the Regional and District levels in the valley, are mainly devoted to matters related to land registration.

4.4 Proposed Future Development of the Irrigation Development Support Services in the Juba Valley

Irrigation development in the Juba valley so far has been taking place in a rather unplanned and uncontrolled manner. This is particularly true for smallholder irrigated farming, but to some extent also for the large-scale irrigation projects, since with all the technical support they received, they where not perceived within any overall irrigation development framework for the Juba river waters. Uncontrolled irrigation development north of Fanoole, resulting in uncontrolled water extraction, is now also contributing to water shortages during the Jilaal dry season for the Juba Sugar project and the banana growers, in the Lower Juba. Furthermore, the present ongoing expansion trend in smallholder irrigation development, would eventually lead to a situation where all available land in a narrow strip along the banks of the Juba river would be brought under irrigation, denying access to the river for future irrigation projects.

Even without the envisaged construction of the Bardheere Dam, strengthening of the irrigation support services in the Juba valley would be necessary, to allow for a rational development and exploitation of its potential for irrigated agriculture. However, within the Masterplan a more dynamic development for irrigated crop production in the Juba valley is envisaged. The following table presents briefly the envisaged development as outlined in the Masterplan.

Table 4.4/1 Envisaged Development of Irrigated Farming in the Juba Valley

Farm System	Present		1995 (1)		2005 (2)	
	Area (ha)	Farm Families	Area (ha)	Farm Families	Area (ha)	Farm Families
Juba Sugar	7,000	n.a.	7,000	n.a.	7,000	n.a.
Large-scale Irr. Projects	2,600	300	-	-	-	-
Medium-Scale Banana Growers	3,400	60	3,400	60	5,000	100
Small-Scale Irr. Farmers	4,100	1,200	16,600	5,440	38,000	13,200
Total	17,100	1,560	27,000	5,500	50,000	13,300

Source: Own investigations.

1) Before dam situation.
2) Situation after dam has become operational.

Table 4.4/1 presents the magnitude of changes as envisaged for the Juba valley until the year 2005. The increase in smallholder participation in irrigated farming, from the present 1,200 to an estimated number of 13,200 farm families by 2005, will result in an increased demand on irrigation development support services, without precedent in the country. This is particularly true, since many of these new irrigated smallholders would have no previous experience in irrigated crop production.

According to the Masterplan, by 2005 an irrigation system efficiency of 40% should be achieved. At the ultimate development (after 2005), when 120,000 ha would be brought under irrigation, an irrigation system efficiency of 60% would be desirable, which is clearly a long way from the present situation.

It is obvious that to allow for the realization of irrigation development as envisaged in the Masterplan for Juba Development, a considerable strengthening of irrigation development support services in the valley is a prerequisite. In view of the fact that these services at the overall national level are but marginally developed and bearing in mind the recommendations of ISNAR (see Section 4.2), it is proposed that MJVD establishes in the Juba valley an organization which will provide the required irrigation support services.

The establishment of such an organization could be a pre-activity for the establishment of an envisaged "Juba Water Development Authority", which would be the field organization of MJVD for the management and proper utilization of the Juba river waters; in particular for all irrigation development activities downstream of the future Bardheere Dam.

While the future mandate and organizational structure of the proposed water development authority are not clearly defined yet, it is foreseen that the authority will be established and developed gradually, according to the development pace of the valley and the dates actual construction of the Bardheere dam will be initiated and when it will be operational. Since irrigation development is presently already taking place, independently of the envisaged Bardheere dam project, the immediate establishment of irrigation development support services are required.

The proposed organization will initially concentrate on advisory and monitoring activities, and the development of technical criteria and guidelines for irrigation development. In a follow-up phase it would, provided it will be equipped with the proper legal mandate, also have regulatory and licencing powers in relation to irrigation development and (irrigation) water extraction from the Juba river.

It is suggested that for the establishment of the irrigation development support organization a special project is created, which would be able to attract the required financial and technical assistance.

The main features of the project would be:

- the establishment of five irrigation development support offices in the Juba valley (one of these offices will eventually be developed as the proposed authorities headquarters in the valley. These offices would not have to be established all at the same time. In a first project phase two could be established, with gradual expansion during the following years, to allow staff skills to be developed as well

- appointment and training of national staff to these offices
- provision of office accommodation, transport, equipment and staff hous- ing
- the provision of technical assistance, through the appointment of one Water Development Adviser to each office, and the provision of consultant services.

The proposed offices would coordinate their activities closely with the Regional and District Agricultural Coordinators of MoA (which are responsible for all matters concerning land registration) and would, in that respect, preferably be established in the same location as the Regional/District Agricultural Coordinators in the Juba valley.

Following are the recommendations as to the main activities the proposed project is to undertake:

(1) Establishment of Irrigation Development Support Offices

It is recommended that eventually five district offices be established in the Juba valley, one each in; Bardheere, Saakow, Bu'aale, Jilib, and Jamaame. They would be established in the vicinity of the offices of the District Coordinators of MoA, on available Government land. The offices will be fully equipped. With each office staff housing would be constructed, in view of housing problems in the Juba valley. To each office the following means of transport would be provided; two 4WD pickup double-cabin cars and two motor cycles.

(2) Appointment and Training of Staff

The following National staff would need be appointed to each district office; one Chief Engineer, two Irrigation Engineers, one Irrigation Planner, one Pump Registration Officer, one draughtsman and supporting staff. Job descriptions for professional staff would need to be elaborated, and a staff training plan developed, after training needs of national staff have been assessed. Apart from local training, fellowships would need to be made available. The offices would be assisted by a team of two advisors, provided under the proposed technical assistance support to the project. The team would consist of an irrigation engineer and an operation and maintenance specialist.

(3) Preparation of Standard Designs, Technical Criteria and Guidelines

Standard designs for small- and medium-scale irrigation systems and their components would be developed, to allow for the future development of those areas to be brought under irrigation as envisaged within the Masterplan. Small-scale irrigation systems are defined as systems with an acreage of up to 15 ha, supplied by one or two pumps, while medium-scale systems are systems with an acreage of 15 to 500 ha. The standard designs would include an estimation of quantities and costs.

Standard selection criteria for irrigation pumps and motors would be developed. Selection criteria would be taking into account the prevalent farm sizes and their (topographic) location vis-a-vis the Juba river. Selection criteria would be developed for farmers irrigating in the proximity of the river with their individual pump and for small- and medium-scale irrigation schemes, which would be located most likely further away from the river.

Standard operation and maintenance guidelines (manuals) for individual irrigated farmers and small- and medium-scale irrigation systems would be developed and made available. These manuals would have to be translated into the Somali language, to make them readable to the local farming community.

(4) Support Services to Farmers

The project would have to assess how assistance to farmers in the establishment of small- and medium-scale irrigation schemes could be provided. The cost of establishing such irrigation schemes would in most cases exceed the financial capacity of the participating farmers. MJVD could play an active role in the development of these schemes and allow the settlement of individual farmers afterwards, under conditions yet to be determined. Alternatively, the irrigation development support office would provide the details of the scheme design, assist farmers in arranging financing of the physical establishment of the scheme and assist in the organization of participating farmers into a water users' association; a body which would than have a legal status. In view of the above presented considerations, the project might initially wish to concentrate on small-scale irrigation development only. These small schemes could be established with active participation of the farmers themselves. Such an approach would promote farmers' involvement not only in establishment, but also in the subsequent operation and maintenance of irrigation systems resulting usually in better managed systems, requiring little interference from Government bodies.

Support provided to farmers for the efficient operation and maintenance of irrigation systems, would be provided in close coordination with the extension service. While the extension service would advise farmers on all matters pertaining to irrigation on the actual farms, the irrigation development support offices would particularly advice on improvements of existing systems and on operation and maintenance of the primary and secondary irrigation (and drainage) infrastructure in the small- and medium irrigation schemes.

The establishment of Water User Groups (WUGs) would only be relevant under those circumstances where a group of farmers share certain irrigation facilities, such as a pump or primary and secondary irrigation infrastructure, and would therefore be dependent on each others participation and cooperation. The present smallholder irrigation development in the Juba valley is mostly individual development, and does not present a social framework conductive to the establishment of WUGs. However, for the small- and medium scale irrigation schemes conditions could require the establishment of WUGs.

The irrigation development support offices would advise and support the farmers in the establishment of WUGs. These advisory activities would be developed in coordination with the extension service in the valley. Experience with WUGs in the Shebelli riverine area would need to be assessed, to determine its applicability under Juba valley conditions.

(5) Monitoring of Irrigation Development

Periodical monitoring of irrigation system and on-farm water use efficiency would be undertaken for all irrigated farming systems in the valley. These include; individual smallholders and smallholders in small- and medium-scale irrigation systems; banana growers and the large-scale projects. Causes of bottlenecks in achieving higher irrigation efficiencies would be identified and measures would be designed to increase overall irrigation efficiency within the different farming systems. Advice to smallholders would be disseminated through the extension service, advice and assistance to banana growers and large-scale projects would be provided directly to these entities.

A register would be prepared and kept up to date of all present and new pumping capacity, installed in the Juba valley; detailing ownership, technical specifications and geographical distribution. Similarly a register would be prepared and kept up to date of all present and newly developed land under irrigation; detailing ownership, size, history of land use and geographical distribution. The establishment of both registers would, in the future, allow the irrigation development support organization or the proposed authority, to exercise its envisaged regulatory and licencing mandate in the valley.

(6) Elaboration of District Irrigation Development Plans

District irrigation development plans would need to be elaborated. These plans would take into account the existing situation of irrigation development and the guidelines for future irrigation development, as set out in the Masterplan. The proposed plans should take into account different development alternatives, incl. the diversion of water and gravity supply versus pumping (as will be analyzed in the Study of Diversion Alternatives, which has been proposed in the Masterplan). The district irrigation development plans would be elaborated in coordination with the the offices of the Regional and District Agricultural Coordinators of MoA, in respect to matters of land registration and land ownerships.

5. Land Tenure

5.1 Land Registration; the Present Situation

All matters pertaining to land use come under the responsibility of MoA; in particular the Department of Land and Water Resources. MoA is represented in the Juba valley through one Regional Agricultural Coordinator in Bu'aale and one in Kismayo, and District Agricultural Coordinators stationed in Bardheere, Saakow, Jilib and Jamaame. Presently staff of the Land and Water Department, at the Regional and District levels in the valley, are mostly devoted to matters related to land registration.

The need for a farmer to have security of tenure of his holding is self-evident; lack of it is certain to result in inefficient and ineffective land use, acts as a disincentive to investments and, as history has shown in other countries, can easily lead to permanent damage being caused to the land (e.g. land degradation as the result of salinisation). A properly executed and incorporated title document would not only convey a sense of security to the farmer, but would also serve as a guarantee to potential lenders, within the latitude allowed by the land law as amended from time to time.

The issue of assured land tenure has been duly addressed; presently in Somalia farmers are encouraged to obtain certificates of registration which would automatically ensure its recording into the land register. Unfortunately the presently required procedures are cumbersome and unsatisfactory. Further complications and delays are caused by the absence of cadastral maps: this compounds the already difficult task of determining indisputable boundaries and can easily result in quite genuine boundary disputes. The many authorities involved at different levels must all listen to submissions, send a surveyor to the area and eventually decide who is entitled to that land. All this takes much time, costs the applicant much money through having to visit the appropriate administrative center(s) and acts as a disincentive to make use of the act. As a result only a very small proportion of agricultural land has been registered in the Juba valley.

A further complicating factor is that, because of the foreseen (irrigation) development in the Juba valley, many individuals who are not genuine farmers but have the necessary resources, are able to make use of the existing procedures to acquire large areas of land, which may well preempt the target population, the smallholder farmers, to obtain their fair share of the land that will become potentially valuable with the construction of the Bardheere Dam.

Another, closely related problem is that ways must be found to ensure access to the river for the benefit of those whose land does not adjoin the river, to enable them to take water channels to their land for irrigation development, for stock owners and those who need drinking water and do not own river frontages. Issues of access will be reviewed in Sections 5.3 and 5.4 of the present report.

5.2 Recommendation for the Future

Under the ongoing Shebelli Water Management and the Shalambod Irrigation Rehabilitation Projects, both supported by USAID, the issue of land registration is being addressed as a matter of priority. The Universities of Wyoming and Wisconsin in the USA are assisting in this exercise.

Therefore, it would appear prudent to extend the same activity to the Juba valley, following exactly the same procedures that are followed in the two projects mentioned above. This would entail, if necessary, to augment the number of registration teams and provide them with appropriate means of transport. They would visit a given area at a predetermined, well-advertised time, so that all applicants can be present. All examinations and hearings would take place on the site or in the nearest village that is easily accessible to the interested parties. The necessary documentation would be issued in the course of a subsequent visit.

5.3 The Land Law; the Present Situation

Under the land law as it now stands, land can be registered in the name of a genuine intending occupant. This registration gives him the right to use the land for 50 years, provided he cultivates it continuously, with a maximum break of two years. Should he not cultivate it for more than two successive years, the land automatically reverts to the State and is available for re-allocation. On the other hand, proper use of the land tacitly guarantees the right of inheritance to the original lessee's heirs.

Under the present stipulations in the land law, no individual may have more than one parcel registered in his or her name. This runs counter to the common practice of risk spreading; having land in different ecosystems and under different farm system conditions (irrigated, rainfed, flood recession farming) spreads the very real risk of complete crop failure under the hazardous conditions of low-rainfall and flood-prone areas.

The situation described above does not provide any security for investment in the land itself. A short-term production loan could be secured by a lien on the crop and the lender could conceivably thus recover his money from a defaulter. Loans for a tractor or a pump can be recovered by obtaining a court order to seize the item for which the loan was given or not actually transferring the title to it until full payment has been made. However, if a farmer wishes to borrow money for land levelling, which, in both the Juba and Shebelli valleys is regarded as essential for efficient irrigation, and most probably also for really effective rainfed farming, the only possible asset is the land itself. Since land cannot, under present legislation, be sold, it is not a realizable security for a loan. Therefore, understandably, lending institutions are reluctant to risk their funds for investments for other than tangible, realizable items or against the security of a permanent dwelling.

Yet another feature of the present leasing arrangements is that granting the title, implies that the land may not be entered by outsiders without the leaseholder's permission. Near the river this would mean that land away from the river, but commandable, may in fact not be irrigated because the owner cannot secure the right to take a water channel across the riparian leaseholder's plot. Similarly, livestock owners, or people in search or drinking water cannot reach the river to satisfy their needs.

5.4 Recommendations for the Future

It is appreciated that resolving the issues raised in discussing the Land Law, would mean going right into the basic principles of the law as it stands at present. However, this may well be necessary. Careful consideration should be given to the matter and a solution developed that is satisfactory to the authorities, and that would encourage investments in, and development of, other than strictly riparian holdings and provide an incentive, and a guarantee, to lend to farmers. While it is appreciated that the present informal arrangements, relying mostly on peer pressure to secure loan repayments may indeed be powerful, no financial institution can accept them as the sole guarantee for a substantial loan for several years; the kind of loan that is implied i.a for the financing for land levelling and on-farm irrigation development by smallholders.

To overcome these bottlenecks, the following concepts are suggested for consideration by experts in Somali law and customs; it would be most pretentious for an outsider to attempt to do more than state the objectives envisaged.

- Access by others than the leaseholder could be resolved by establishing the principle that water channels may be taken across another person's land, provided such channel does not interfere with the leaseholder's routine farming activities and if an appropriate rent or other form of compensation is paid for the land of which the leaseholder has been deprived. Stock and people drawing water from the river should only proceed on approved and agreed routes and the leaseholder should be protected from inadvertent damage by adequate fencing, which might (in some cases) be provided by those wishing to have access to the river.

- Investments in the land, and nonpayment either by deliberate default or because the leaseholder has decided to abandon the land, present a more substantial problem. Possibly the only solution is to grant right of use of land to the lender who then may farm it, or sublet it, until such time that he can satisfy the authorities that his debt has been discharged. Whether this, or any other solution is finally accepted, the principle of a safeguard to lenders, to permit farmers to invest in actual land improvement (land levelling, irrigation development, etc.) needs to be addressed urgently.

The issue of a leaseholder being allowed to register more than one parcel of land needs to be resolved. It is understood that the authorities, recognizing the important risk-aversion feature of this aspect of farming in Somalia, are in fact allowing multiple registration. However, it would be necessary to formalize/legalize this arrangement, especially in view of the fact that the intended smallholders in Mogambo and possibly Fanoole would need crops other than rice or sesame to sustain their traditional lifestyle, which implies feeding their animals with crop residues when grazing is poor. If it would not be possible to grow other crops than rice and sesame within these irrigation schemes, they would have to keep or acquire land outside the schemes, to cover these requirements.

6. Agricultural Credit

6.1 The Present Situation

Institutional credit for agriculture is provided through the Commercial and Savings Bank of Somalia (CSBS), responsible for seasonal credit, and the Somali Development Bank (SDB), responsible for development credit. This latter bank, confined to the main urban centers, has done little agricultural business so far. In those cases were SDB credit has been given for agricultural development, it was for tractors and implements, water pumps and pickup trucks. Security for the loans is either peer pressure as described below or a brick- or stone-built house owned by the borrower. Record of repayments is reported to be not very good, nor would it appear that these present borrowers are the kind of farmers which in the Masterplan have been identified as its target group.

In any case, main farmers' needs for credit up to now would have been for seasonal credit. Limited credit availability has not proved an important production constraint in the past, and the greater use of purchased (seasonal) inputs, at present, will most probably depend more on their ready and timely availability than on farmers' access to credit. However, due to improved farming practices, as envisaged in the Masterplan for Juba Valley Development, some growth in demand for seasonal credit is to be expected.

The CSBS, with 40 branches (including branches in Kismayo and Bardheere in the Juba valley), is best placed to service the farming community. However, the CSBS has been cautious about lending to farmers to date, particularly to smallholders.

When CSBS provides seasonal loans, they usually invite an established formal or informal village community, where they feel assured that the leaders are able to exert sufficient peer pressure to ensure loan repayments, to apply for loans for their members. In practice they have been working almost entirely with informal associations, usually in villages where it was known that the water users association (WUG), a strong traditional body in the Shebelli valley, is really effective. Through the village leaders, who are usually also the "fathers" (Aw) of the Water Users Associations, they lend the farmers their requirements in kind; cash as such is not handed over to the borrower. The requirements are fertilizers, pesticides, possibly also purchased certified seeds, tractor hire services and occasionally, hired labour, paid by the "Aw". The borrower has to pay back the money owed after he harvests and sells his crop. Experience to date, be it with a small-scale, very carefully selected and monitored organization, has been excellent: repayments are reported to be near 100%. It has to be noted however, that the system as described above, is not common in the Juba valley, where presently no WUGs exit.

CSBS own limited efforts in providing seasonal credit to smallholders have been reinforced by the Seasonal Credit for Small Farmers Project. This project is funded by the United Nations Capital Development Fund and executed by CSBS. Initially the project has concentrated its activities in the Shebelli valley. United Nation's support is expected to continue beyond the 1989 closing date of the credit project. In case this situation changes, support of the International Development Association (IDA) is being considered in support of credit for future agricultural lending operations. Actual estimates of past or present (seasonal) credit disbursements in the Juba valley could not be obtained, but they seem to be very low.

The question of long-term credit, i.a. or land levelling or other types of on-farm development, has not arisen in the past. Although a considerable amount of land levelling has been done - it is a routine operation in the Janaale-Bulo Mareta project and is practiced by all banana growers and many private, well-to-do farmers - the banks have not reported any specific cases of borrowing for such purposes. It may well have been described as "tractor hire" and secured against another valuable asset of the borrower.

6.2 Recommendations for the Future

In the future, the question of security for credits would require a more careful and systematic approach than is the case at present. While the overriding influence and necessity of peer pressure cannot be overemphasised, it equally cannot be the only assurance that loans will be repaid. A form of fall-back arrangement has to be made to deal with the recalcitrant, otherwise experience shows that the example spreads; it is a truism to say that nobody likes to repay loans, especially if it is assumed that the money comes from a distant government organization. Therefore a mechanism to provide the banks with a tangible, enforceable mechanism for the three kinds of credit described (seasonal, medium- and long-term) must be identified. Furthermore, the following suggestions are presented:

(1) Short-Term Credit

For short-term credit it is suggested that the lending organization secures a lien on the crop and ensures that the organization buying it will not pay the seller until the lending bank is satisfied that the debt has been, or is about to be, repaid. Since by now few growers sell grain to the ADC, peer pressure must be exercised on the village traders, and also on traders normally visiting the villages to contact the Aw (or somebody holding a similar social position) before dealing with villagers known to have taken a production credit. Clearly this would not be a foolproof arrangement but could, conceivably, reinforce simple peer pressure on the potentially recalcitrant borrower.

(2) Medium-Term Credit

Medium-term credit to purchase tangible assets, like tractors, implements or irrigation pumps, should be secured against the item purchased, i.e. the ownership should not formally pass to the borrower until the loan is repaid. Since the borrower would be called upon to pay not less than 20% of the purchase price out of his own resources, the bank can be reasonably certain that on repossession it would recover the money owing to it. It would also have to insist on insurance against accidents and theft. Experience shows that this arrangement works very satisfactorily in India and Pakistan, and similar arrangements could be experimented within the Juba valley.

(3) Long-Term Credit

Long-term credit, i.e. for land levelling which would have to be for 7 to 10 years, presents a serious problem to which a solution is not readily apparent under present circumstances. The only security that can be offered, apart from peer pressure, would be the land itself. But since land cannot be legally sold or leased, the lender has no means to recover his money, not even by forcing the borrower to lease his land to a would-be tenant approved by the lender. Moreover, should the borrower not cultivate the land for more than two years, he looses it and all possibility of recovering the loan is also lost. This is clearly an issue that has to be addressed through legislation, and has been discussed already in some detail in Sections 5.3 and 5.4 of the ANNEX.

(4) Interest Rates

It is essential to preserve the value of the disbursable loans. This can only be secured by a realistic positive interest rate structure. In the past, interest rates were negative in real terms. If interest payment is not acceptable, an adequate scale of service charges must be introduced. The purpose of interest/service charges is to finance the lending organization's legitimate costs and to preserve the value of its capital: the money repaid by one borrower for buying a tractor, for instance, must be sufficient to buy a similar tractor for the next borrower. Therefore it is essential that interest rates continue to be so set as to meet both these needs, i.e. must cover not only the operating costs of the bank but also any inflation and currency devaluation that may occur. It will therefore be essential to review interest rates frequently and to adjust them at least once a year to forestall capital losses of the lending institutions suffered by inflation. This may not be practicable, or even essential, for short-term production loans, but almost inevitable for medium and long-term loans.

(5) Organization

An organization has to be built up that will speed up the granting of short-term loans and collects applications for other loans. This would most probably consist of a two-man team: the extension agent of the area and a staff member of the bank concerned. They would visit the village at prearranged, well advertised times and review loan applications. The bank representative would prepare the necessary documentation and arrange the delivery of inputs through the ADC or other appropriate organizations. Applicants for medium and long-term loans would have to visit the bank offices at mutually convenient times to sign the necessary documentation. The borrower would not be given cash but the appropriate piece of equipment or present bills for tractor hire for land levelling.

Although at present there appears no immediate need to organize the services of mobile bank units in the Juba valley, this possibility should be reviewed again at a later stage. After the actual construction of the Bardheere dam has been initiated and particularly after the dam becomes operational, it is to be expected that there will be a strong increase in the demand for all the three types of credit. A detailed study would be required at that time, to estimate the development of credit demand and in which way present or new institutions could best serve this increased demand.

7. Tractor and Machinery Hire Services

7.1 The Present Situation

ONAT (Organisazione Nationale Altressi Trattore) is a Government institution under the authority of MoA. This organization was first established in 1955 as an agency under the Credit Bank of Somalia. Since that time ONAT has performed different types of activities, but at present its main activity is to provide tractor hire services for bush clearing, land levelling, ploughing and harrowing for private farmers and for Government projects. Additionally, flood control measures and the construction of irrigation works are carried out. Headquarters of ONAT is in Mogadishu, with a network of agencies with regional and district workshops distributed over the country. In the Juba valley ONAT presently maintains a central agency and a regional workshop in Jamaame, and agencies and district workshops in Jilib, Bu'aale and Bardheere.

A resume of the deployment of ONAT in the Juba valley (1984, most recent figures available) is presented in Table 7.1/1

Table 7.1/1 Staff and Equipment of ONAT in the Juba Valley (per District)

	Jamaame	Jilib	Bu'aale	Bardheere	Total
Number of staff:					
Administration	6	8	4	3	21
Drivers	50	75	16	14	155
Technicians	25	10	4	2	42
Equipment:					
Tractors (60-70 HP)	22	33	11	13	79
Bulldozers	4	3	1	1	9
Trucks	1	1	-	-	2
Landrovers	1	1	1	1	4

Source: [125]

A more recent (1987) analysis of ONAT's performance shows that at the moment the central agency at Jamaame has almost no significance for the farmers in that area, and that the agencies at Bu'aale and Bardheere offer machinery services on a very limited scale only. ONAT's efforts are nowadays very much concentrated in the District of Jilib, i.e. on the provision of machinery and equipment to the Juba Sugar Project. Presently an estimated 75% of all ONAT staff in the Juba valley in concentrated in Jilib. As a result of this heavy support from ONAT to the Juba Sugar Project, compounded by economic problems as a result of the countries overall economic problems, no further bunds clearing, land preparation, construction of irrigation canals, etc. is carried out for private farmers in the various Districts of the valley. The provision of a limited amount of machinery services was reported only for Bu'aale and Bardheere Districts. ONAT charges SoSh 700 per of hour of work done (rate April 1988) and requires cash payment. This rate does not represent the real cost of the service, while also no charge is made for bringing the tractor to the actual farm site.

The Mogambo Irrigation Project operates a comprehensive contracting service for its smallholder settlers. They do land preparation, planting and harvesting, and deduct the cost of the services rendered after the harvest from the value of the crop grown, for which they are sole buyers. Unlike ONAT, they use shallow, fast-moving implements which prepare a satisfactory seedbed with a single or at most two passes, each taking less than half an hour/ha. Thus total land preparation time is about one hour per hectare, compared to ONAT's 4-5-hours.

In addition to ONAT, machinery services are also offered to a very limited extent by SOMALFRUIT; to banana growers in the Lower Juba, and by SOMALTEX to cotton growers. According to information from SOMALTEX, 1,500 ha were ploughed and harrowed by them in 1986. Apart from the cotton producers and the settlers of the Mogambo Irrigation Project, the bulk of the smallholders in the Juba valley presently have no access to farm machinery.

Private ownership of tractors or any other heavy farm machinery is insignificant in the Juba valley.

Presently there is an unfullfilled demand for tractor and machinery services in the Juba valley area. The demand is created by the fact that land preparation and planting are normally carried out by hand and can take up to 10 or 12 man-days per hectare, depending on the weeds that have to be disposed of. If infestation with perennial, stoloniferous weeds is serious enough, it may compel the farmer to fallow the land for one or more seasons and spend perhaps up to 40 or 50 man-days just to remove and kill the weeds, without getting any direct reward for his labour. The judicious use of the appropriate animal or tractor-mounted implement can reduce the time required for land preparation and most probably do away with this involuntary fallow period. The issue of animal traction is discussed in APPENDIX 4 of the present report.

Another issue compounding the availability of machinery services is that, based on experience elsewhere with the soil types encountered in the Juba valley, the present selection of implements used for land preparation is incorrect. The self-mulching vertisols prevalent in the valley do not normally require the use of a furrow-turning plough except for occasional weed control operations: in fact the use of a plough on dry soils, i.e. before the rains, will produce large clods that require much labour to break or, if not broken, interfere with subsequent planting operations and germination of the seed.

7.2 Recommendations for the Future

The need for an expanded tractor hire service would appear a precondition to achieve the development objectives for agriculture in the Juba valley, as have been identified in the Masterplan. Timeliness of operations is of vital importance in rainfed areas, to make the best use of available moisture by speeding up land preparation and would seem only marginally less important under irrigated conditions. More specifically, the following recommendations and considerations are presented:

(1) Fuel Supply

In the past one of the major arguments against mechanization were the difficulties to obtain sufficient fuel at critical times, thereby damaging the prospects of farmers relying on tractor cultivation. While of course no assurance can be given that there will not be future shortages, the accepted view appears to be that, through whatever means, diesel fuel will have to be imported in large quantities for other purposes at all times and that the demands of agriculture will, for the foreseeable future, form a small part only of total requirements. Therefore it would appear acceptable to assume fuel availability.

(2) The Economics of a Tractor Hire Service

The service would be one in which demands for it peak and slump sharply. A study carried out by the British National Institute of Agricultural Engineering's Overseas Division on tractor hire services in developing countries concluded that a service geared to meet urgent, sharply peaking demands, tends to favour the influential customers at the expense of smallholders, who are the target group of the envisaged development in the Juba valley. They have also found that a service designed to meet peaking demands, and would have little to do at other times, is rarely economical. While these issues cannot be ignored, it is expected that the hopefully growing demand for land levelling, which will have to be, even be it initially in a small way, an ongoing operation (see APPENDIX 3), would at least alleviate, if not overcome, such loss-making. Furthermore, the proposed selection of implements (see below) will allow for speedier land preparation and thereby assist in some way to ensure a more universal access to tractor services.

(3) The Alternative to Mechanization

The alternative to mechanization must also be considered; this is to continue with hand cultivation, which limits the area a family can cultivate and also may prevent them from carrying out vital farm operations under optimal moisture conditions, which is of particular importance in rainfed crop production. Animal traction, tried many times, would presently not yet appear to be a viable alternative for land preparation, at least not without much further basic research work (see APPENDIX 4). Therefore, it is advisable to accept some of the risks outlined above and at least make a determined attempt to gradually mechanize rainfed agriculture in the future.

(4) The Choice of Implements

It is suggested that the implements used prior to planting on the black and brown self-mulching soils of the Juba valley be the shallow, fast disk and the scarifier, as presently is being done in the Mogambo Irrigation Scheme. A 60-70 HP tractor can easily handle such an implement (which is about 4 m wide) and cover one hectare in about 30 minutes, travelling at about 10 km/hr. There will continue to be a need for disk ploughs for use on land heavily infested with stoloniferous weeds; burying these weeds in the jilaal may well obviate the need for the presently practiced laborious, and often not very successful fallow.

(5) Availability of Spare Parts

A further problem is that of spare parts and an efficient repair service. One way to alleviate this problem would be to introduce a much greater standardization of tractors and equipment than at present. Once again experience in other countries, that have introduced mechanization, has been that a multiplicity of models is counter-productive to solving problems in provision of spare parts and servicing problems. For instance Pakistan, with a farmed area of well over 10M hectares, allows only two kinds of tractors to be imported; India uses no more than three or four models. In neither country is the obtaining of spare parts a problem: if not available locally, neighbouring areas are certain to have them.

(6) Private Entrepreneurs

Finally, private entrepreneurs should be encouraged and small-scale farmers motivated to purchase shares in a tractor, operated by one of them, or through an users' association. However, it would first have to be ascertained beyond any doubt that the investment would be beneficial. It may well be that the tractor could be used extensively for off-season transport or other operations, which would make wider private ownership feasible. Such developments would have to be carefully monitored.

APPENDIX 1

Outline of Proposed Training Programme in Soil - Water Management Extension

1. Objective of Training Programme

Before irrigation was practiced, farmers adjusted their farming operations to the requirements of rainfed agriculture. However, once irrigation is introduced, more work is required from the farmers and new production techniques are needed. A big change in farmers' habits of work and even pattern of life has to take place. Efficient irrigation calls for a farmer who is equipped with the required technical skills and applies suitable methods of farm management. Smallholder irrigated farmers in the Juba valley have not yet acquired these required skills levels, which is manifested by an overall low irrigation efficiency of 20% of their systems. Furthermore, under the envisaged development scenario for Juba valley development, many more smallholders will become involved in irrigated crop production, with no or little previous experience with this farming system.

The extension service must therefore be able to assist and train farmers to practice efficient and technically sound irrigation on their land. The objective of the training programme will therefore be as follows:

- To provide extension staff and in particular the FEAs, with adequate knowledge to enable them to communicate to smallholders, in an understandable and practical manner, the technical and skill requirements and parameters to practice irrigation in an efficient way. The training programme should be designed in such a way as to allow the extension staff to acquire essential information on irrigation (practices) and soils, to understand technical instructions and to cooperate with the SMS, farmers and other organizations involved in improving and supporting irrigation development in the Juba valley.

2. Teaching Methods

To ensure the desired impact of the training programme on the professional performance of extension staff, the programme should be practically oriented, taking into account the educational and professional background of the participants to be trained. The learning effect may be strengthened if extension staff are induced to follow.the training programme in a motivated manner. To increase motivation it is recommended to encourage active participation of the field staff whenever possible. To keep interest up on theoretical matters, use of appropriate audiovisual aids is recommended and the issues should always be related to their practical application.

Practical field work is the most important part of the programme, since extension field staff will have to transfer their newly acquired knowledge to the farmers. Therefore, it is recommended to give first the information in a theoretical outline, while afterwards this will be followed up by practical work. For practical field work two steps are distinguished; a guided practice under the instructors' supervision and an independent practice, where students develop skills and confidence to transmit their newly acquired knowledge to the farmers.

3. Contents of the Programme

The SMSs in soil - water management, together with the short-term consultants, will have to elaborate the detailed contents of the programme. However, basically the programme should follow the following outline:

- Soils: Over and above the basic training in the simple classification of soils (with particular reference to the representative soils in the Juba valley) and the influence of soil composition and its physical properties on fertility and plant growth, the extension staff would have to acquire a basic understanding of the physical interaction between water and soil, in particular:

  . water movement in the soil profile, infiltration, usable water storage, capillarity, lateral movement of water and deep percolation

  . physical impediments to water movement and root growth in the soil, and groundwater influence

  . the hazards of salinity in the Juba valley

  . erodibility of the soil surface.

- Climate and crop water requirements: For advisory work in irrigated crop production the FEA must have basic knowledge of the relationship between climate and water requirements of crops. Therefore they will receive an introduction to the following subjects:

  . interpretation of climatological data (rainfall and potential evapotranspiration)

  . relationship between potential evapotranspiration and crop water requirements and changes of water requirements depending on crop growth

  . changes in soil moisture due to water extraction, rainfall and irrigation

  . the influence of other climatic factors such as wind, temperature, etc.

- Irrigation water application practices: Field application systems and on-farm water management techniques, appropriate to Juba valley conditions, which will include the following topics:

  . conversion of crop water requirements into irrigation requirements, application rates and irrigation schedules

  . water losses on the field and disposal of excess water

  . control and possible measurement of the inflow in the field

  . proper field operation of the system and its possible malfunctioning

  . appropriate land preparation and land levelling methods and criteria

  . damage caused to soil and crops due to over or under irrigation.

- Water user groups (WUG). The extension officers will have to be familiar with the function and position of water user organizations in irrigated farming area. The following aspects will have to be dealt with:

  . function, responsibilities and organizational models of WUGs

  . review of present system of WUGs in the Shebelli riverine area and its possible relevance to the Juba valley

  . role of extension staff in the establishment of WUGs in the Juba valley.

4. Course Organization

It is proposed that the training programme will provide four training courses of one month duration each. Two courses for the extension staff in the Lower Juba Region, to be held at the ETC in Yontoy, and two courses for extension staff of the Middle Juba Region and Bardheere District, to be held at the facilities of the proposed Bardheere Research Station, or an alternative location to be selected. The time lapse between the two courses will be about one year. During the second course impact of the first course on soil - water management extension skills of field staff will be evaluated, consolidated and reinforced.
Details of the two courses will be elaborated by the short-term consultants in cooperation with the SMSs soil - water management.

It is suggested that consultant assistance will be provided by a team of two specialists; an irrigation agronomist and a soil management specialist, both familiar with the specific aspects and problems pertaining to soil - water management in smallholder irrigated farming, preferably in Africa. Furthermore they should have adequate experience in training at the technical level as required for this training programme.

5. Training and Extension Materials Development

The short-term consultants will have particular responsibility for the development of practical field manuals and appropriate visual aids, covering the most important technical aspects of appropriate soil - water management, to be used by the extension staff in their field work. Support of AFMET headquarters in the production of these training and extension materials would be required.

APPENDIX 2

Reconnaissance of Irrigation Practices in Somalia

by ISNAR 1984

1. Introduction

This report was prepared as a part of Somalia's national research programme, which is being assisted by ISNAR. This effort is focused on irrigation water management. The author visited the right and left banks of the lower Shebelli River, the middle Shebelli River, including Jowhar Reservoir, and the Afgoi area. Many individuals were consulted and many reports reviewed about irrigation in Somalia.

This reconnaissance study to identify the priority needs of irrigation in Somalia follows the concepts and principles outlined by Lowdermilk et al (1). This report discusses water supply conditions and field irrigation practices, summarizes crop production limitations, and briefly reviews the socio-economic circumstances of irrigation in Somalia. Research needs are suggested, and recommendations for a water management programme are outlined.

2. Background

The irrigated soils of Somalia appear to montmorillonitic clays that swell and shrink under wetting and drying conditions. Infiltration rates are low, frequently less than 25 mm/h and sometimes less than 2 mm/h. They have high water holding capacities, usually as much as 200 to 240 mm or more per meter (2). According to some reports, at depth below 30 cm and sometimes at the surface, the soils commonly have salinities above 5 millimhos/cm, which suggests serious salinity problems, unless careful irrigation practices are followed.

Somalia's climate is characterized by two rainy and two dry seasons. Non-perennial crops are irrigated during the two rainy seasons; thus, irrigation is supplemental to rainfall for many crops. Surface drainage is required, and evapotranspiration rates exceed 7 mm/day because of the hot, arid climate (3).

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1) Lowdermilk, M.K. et al. 1983. Diagnostic Analysis of Irrigation Systems. Water Management Synthesis Project, Colorado State University, Ft. Collins, Vol. I, 188 pp.
2) FAO. 1975. Pilot Project for Irrigated Agricultural Development on the Shebelli River, Somalia. Irrigation Practices and Crop Production. UNDP, FAO, Technical Report 1, Rome, 138 pp.
3) FAO. 1977. Water Use in Irrigated Agriculture. Democratic Republic of Somalia. A Country Brief. FAO, Rome, 66 pp.

Water supply comes from rainfall and run-of-the-river irrigation, with some storage and some groundwater, particularly in areas near the river, and where irrigation has been practiced for some time. Most reports characterize irrigation as inefficient, with estimates of the irrigation efficiency at 20% (1, 2, 3). Shortages of irrigation water exist during the dry season in some years because the demand exceeds the supply available.

Management units in irrigation consist of:

- commercial concessions for bananas and sugar
- some state farms
- some farms for resettlement of nomads
- other areas where government-developed diversions supply water to farmer owner-operators
- private or group-developed diversions or pumping stations.

Productivity levels are low. Inputs such as seeds, fertilizers, and insecticides are not generally available. Some farmer organizations are controlled by the government, while others operate largely outside government services.

3. Water Supply

Water for irrigation in Somalia comes primarily from run-of-the-river gravity diversions and pumping stations. One off-river storage site of approximately 200 million cubic meters is available to augment low flows on the Shebelli. Other storage reservoirs are planned or have been proposed.

A major constraint of diversions from river flow is the lack of dependability of the supply, especially (as now in Somalia) when demand for water in the irrigated area exceeds the supply available at low flow. Major concerns, then, are allocation of the minimum supply for effective use, and administration of water rights as the irrigated area continues to expand. Such concerns should be the primary responsibility of an overall irrigation agency to insure effective use of available supplies. Several reports have made this recommendation to Somalia (2, 3, 4, 5). In addition, priority needs for development of additional supplies should also concern this agency.

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1) Sir M. MacDonald and Partners, Limited. 1978. Genale-Bulq Masesta Project. Master Plan. Main Report. Sir M. MacDonald and Partners, Limited, Demeter House, Cambridge CB1 2RS, United Kingdom, Vol. 1, p.2.10.
2) FAO/CP World Bank Identification Mission. 1983. Irrigation Rehabilitation Project. Project Brief. Somalia.
3) World Bank. 1981. Somalia Agricultural Sector Review. Vol. II, Annex 2, Water Resources Development.
4) Hunting Technical Services and Sir M. MacDonald and Partners. 1969. Project for the Water Control and Management of the Shebelli River, Somalia, General Report Vol. 1.
5) UNDP/FAO. 1967. Agricultural and Water Surveys, Somalia. Final Report, Vol. I, Rome.

Rainfall - An important source of water in irrigation is rainfall. During the two rainy periods, rainfall can be used as part of an effective water management programme. Level basin irrigation systems will permit effective use of rainfall. During these periods, irrigation water deliveries should be managed to prevent overirrigation and wastage of irrigation water. The small irrigated areas should allow this objective to be easily achieved.

Groundwater - Most reports on groundwater in Somalia report groundwater as too saline for irrigation (1, 2, 3, 4). Some reports give areas of fresh water, particularly in direct association with canals and/or canal irrigation (1, 2, 4). Results from studies in Pakistan directly provide both the theory and practice for effective skimming well design to maximize the recovery of fresh water (5, 6). Groundwater has been developed in a number of irrigated areas to supplement surface water resources, particularly during periods of low river flow.

Conjunctive use of surface water and groundwater is an important part of any effective management programme. Groundwater provides an important supplement to surface water during periods of peak water demand. Also, groundwater can continue to meet some water demands during periods of low river flow. Use of groundwater for irrigation provides direct major benefits, but the water pumped also counts directly for drainage requirements if a salinity balance is maintained.

With saline groundwater and significant salinity in the soils of Somalia, water table control, an effective salt balance, and minimization of deep percolation are all important parts of a water management programme to sustain irrigated agriculture. In addition, agricultural production can be increased and sustained. A water management programme that includes effective use of surface water, rainfall, and groundwater will provide for maximum use of water resources.

Main system delivery - Gravity diversions from the river involve either a project area or a private association of farmers. Some projects have constructed barrages to control the river level and resultant diversion rate. Others divert by gravity as a function of the river level. Most canal inlets also have gates to regulate canals inflow.

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1) Sir M. MacDonald and Partners, Limited. 1978. Genale-Bulq Masesta Project. Master Plan. Main Report. Sir M. MacDonald and Partners, Limited, Demeter House, Cambridge CB1 2RS, United Kingdom, Vol. 1, p.2.10.
2) World Bank. 1981. Somalia Agricultural Sector Review. Vol. II, Annex 2, Water Resources Development.
3) Hunting Technical Services and Sir M. MacDonald and Partners. 1969. Project for the Water Control and Management of the Shebelli River, Somalia, General Report Vol. 1.
4) Johnson, J. 1978. A Conceptual Review of Somalia's Groundwater Resources. FAO, Rome.
5) McWhorter, D.B. Steady and Unsteady Flow of Fresh Water in Saline Aquifers. Water Management Tech. Report No. 20, Colorado State University, Ft. Collins.
6) Zuberi, F.A. and D.B. Mc.Whorter. Practical Skimming Well Design. Water Management Tech. Report No. 27, Colorado State University, Fr. Collins.

Two important functions at each diversion, which need to be established and managed by an organization, are:

- the quantity of water that needs to be diverted, and

- the quantity of water allowed to be diverted as a fraction of the river flow (to maintain equity among diversions).

In the latter instance, the amount diverted is not an issue when the river flow exceeds demand. When the river flow is less than demand, the right to divert must be established and managed by an organization.

If farmers are given the right to divert water according to demand, it is important to establish the flow rate to be diverted to supply the demand. A management unit which establishes this demand and manages the diversion flow rate is needed. Effective water management requires that this demand be established explicitly and the flow rate monitored by a measurement structure to ensure that excess water is not diverted. The same organization needs to establish procedures to determine demand for water. With the small areas involved in most projects in Somalia, a demand system to a lateral outlet that serves a group of farmers can be used. Several methods can be used to involve farmers in establishing water needs, and to advise farmers of decisions affecting water supply. Experiences in other countries (1) suggests that farmer involvement is essential for efficient distribution of water. Farmers also need adequate, timely information on water supplies for the season, and expected delivery schedules.

Efficient delivery of water requires careful system design, effective operating practices, quality construction, and timely maintenance. Management of these functions requires skilled manpower and an effective organization. Observations of facilities in Somalia suggest maintenance is lacking, structural control is inadequate, and water measurement is absent, even though measurement is essential for management of the delivery of water. Improved structures are also needed for diverting water with reduced sediment content. Many canals were observed to be affected by sediment so as to reduce capacity, cause excessive losses (including overtopping), and require excessive labor to maintain.

Technical assistance also appears to be needed by farmer associations and others in the management of the delivery of water. The same constraints cited above exist but are accentuated. Also, inapproriate pumps (centrifugal pumps are used, but propeller types are needed), and inability to extract water at low river levels are major problems. Appropriate channel design (channels too high and two low have been reported and observed), more appropriate structures, and better management all appear to be needed.

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1) Lowdermilk, M.K. and D.L. Lattimore. 1982. Farmers Involvement. Planning Guide No. 2, Water Management Synthesis Project, Colorado State University, Ft. Collins.

Organizational needs - Several organizational approaches to improved diversion and distribution of water to the farm can be considered. The present structure involves Land and Water Department (Ministry of Agriculture) personnel assigned to projects to control diversion and delivery functions. These personnel appear to serve project objectives with limited supervision from the Department. Also, lack of experience, and appropriate policies and procedures appear to limit effectiveness. (At present, most Department personnel are Faculty of Agriculture graduates with one year of additional training, not necessarily as an engineer.) Overall irrigation policy appears to be neglected.

The function of the Land and Water Department for water control for improved irrigation needs to be developed as follows:

- administration of water law and allocation of water rights for both surface and groundwater
- planning, design, and supervision of construction of irrigation projects
- management and monitoring of diversions, and use rights to surface and groundwater
- management of the delivery of irrigation water (including planning, design, construction, operation, and maintenance) for projects, estates, private groups, and others
- development of water supplies
- monitoring and evaluation of water resources for irrigation
- initiation of an on-farm water control service.

The above functions need to be assigned and developed. There is an urgent need for a well-trained staff to provide technical direction and effective management to the irrigation sector in Somalia. The Department would focus on the functions defined above:

- planning, design and supervision of construction for diversion and delivery of irrigation water
- management of the delivery of irrigation water
- water supply development, including groundwater, and
- administration of water rights.

The Department would focus on these functions with the goal of effectively extending the irrigated area through better management of water and the development of additional supplies. In project areas, operational personnel could still answer to project managers for effective distribution of water. The Department, however, would provide technical and administrative support, and any necessary backstopping for effective management of both the project and the entire irrigation sector.

A major constraint to an effective irrigation agency in Somalia is the Land and Water Department's inability to recruit and retain irrigation engineers. No irrigation engineers are produced by the Faculty of Engineering or the Faculty of Agriculture in Somalia. As a result, engineers are in short supply. They are provided at present only by individuals who go abroad for training at the B.Sc. level, usually for five years. Engineers hired by the Department usually leave to go to projects or to more remunerative employment. Personnel allocation policies are also a constraint, as general agricultural graduates are assigned to the Department. Recruitment and retention of engineering staff is an urgent need.

4. Farm Irrigation Practices

Irrigation practices are discussed for the farm in terms of the delivery of water to the field, the application of water to the field, the use of water by crops, and the removal of water, or drainage by surface and subsurface means. Each system will be discussed in terms of priority constraints and programme needs for improvement.

Delivery to the Farm - The first concern in delivery ot water at the field level is that the flow rate be appropriate for the field application system. In Somalia, field application systems are modified wild-flooding systems that are inherently very inefficient (Figure 1). They are classed as modified wild-flooding because each bunded unit has a two-directional slope as well as deviations from the average surface elevation of the field. This modified wild flooding is further classed as a graded irrigation system. Graded irrigation systems require that the flow rate to the field be adjusted to allow the rate of advance and recession to exactly balance the opportunity time to infiltrate the required irrigation. In Somalia, this is a major constraint because with the low intake soils, these opportunity times must equal a minimum of three hours, and in many instances may equal 24 hours. This precise regulation of the flow rate is not considered possible by either the capability of the irrigation system or the knowledge of the farmer.

The low-intake soils in Somalia suggest that the field irrigation system should be a level-basin irrigation system. This allows irrigation with any flow rate that is the minimum for the size of basin available and a maximum based on the erosion constraint for the soil. In addition, the opportunity time for infiltration can be sufficiently long to infiltrate the desired depth of application, including any additional amount needed for leaching of salinity.

Under present conditions in Somalia, the graded field irrigation systems do not permit a uniform application of water, result in underirrigation of the upper areas of the basin, and overirrigation of the lower areas of the basin (Figure 2). In fact, since farmers use cuts in the bunds to allow flow from border to border, the last basins receive excessive water to the detriment of the crop, or the farmer must waste the water to unirrigated or waste land. This is a major factor in poor crop stands and yields because of both under- and overirrigation. Underirrigation contributes to salinity accumulations, and overirrigation contributes to a high water table, which also increases salinity.

Figure 1 Methods of Uncontrolled Irrigation, including a) Wild Flooding, and b) Modified Wild Flooding

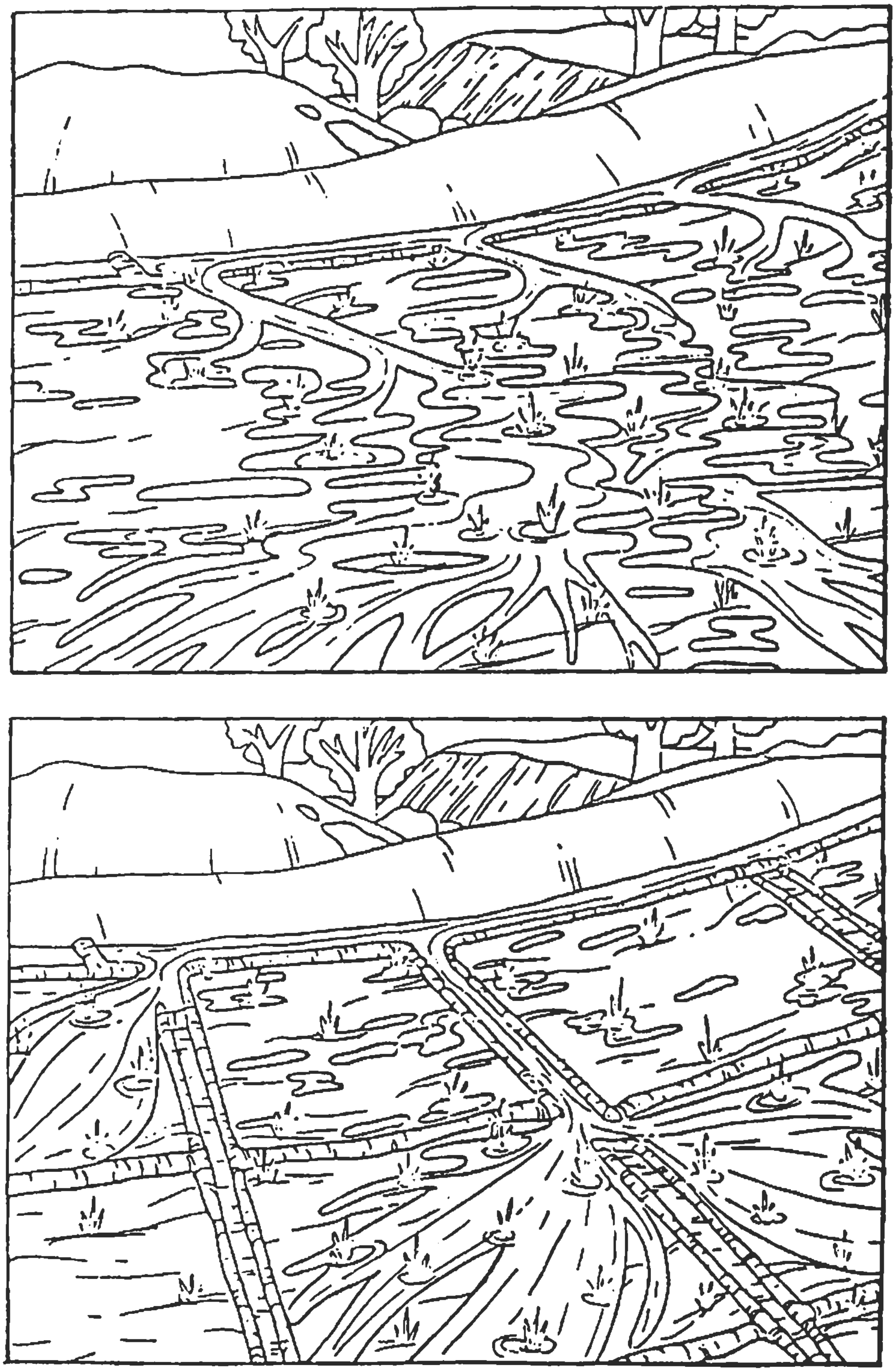
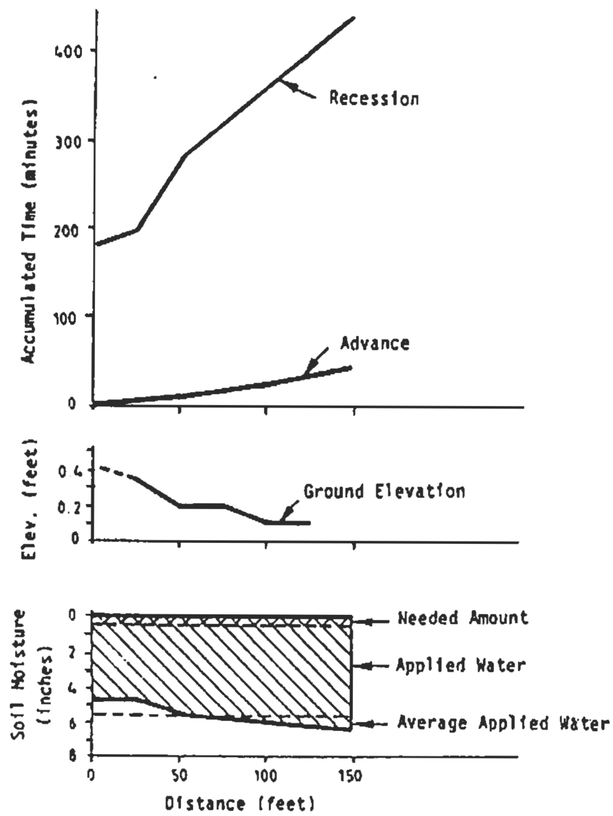
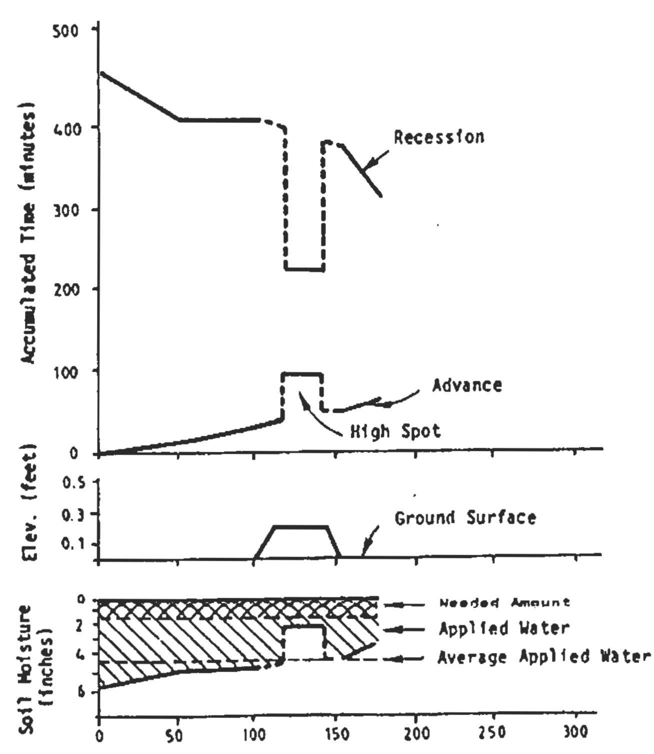


Figure 2 Some Water Distributions Expected for the Field Irrigation Systems Presently Used in Somalia





Water delivery at the field level also needs to reflect the crop water requirements. This means less frequent irrigations when the crops are small or the evapotranspiration rates are low, and more frequent irrigations when the crops are sensitive to water stress and the evapotranspiration rates are high. With the relatively small irrigated areas in projects in Somalia, demand or modified demand systems can be provided to increase the effectiveness of water use and maximize crop production.

One of the most serious constraints to improved crop production and effective water management is undependable delivery of irrigation water at the field level. In studies in several countries, the effects of an undependable water supply on farmers decisions have been carefully documented. Farmers are unwilling to make investments in improved seed, in increased fertilizer application, in other inputs to increase yield, or in even careful management of inputs and practices, when the water supply is undependable.

In Somalia, repeated instances of unreliable supplies of water were encountered in conversations with farmers. Productivity of the water depends on the farmers' willingness to make the investments in inputs and services, and improved management to provide increased yields at the farm level. A system for reliable delivery of water at the farm level will be the most important constraint for irrigated agriculture in Somalia.

Field application systems - The present form of irrigation in Somalia is modified wild flooding. Wild flooding is a system of irrigation usually practiced by farmers when irrigation is first initiated, until technology, knowledge, and productivity provide farmers with more appropriate methods of irrigation (Figure 1). Wild flooding is characterized by irrigation applications of 15 - 25 cm or more, and extremely non-uniform distributions of water. In some areas, low-intake soils retard infiltration, with the result that sufficient water cannot be provided for effective crop production, but water applied as still very non-uniform (Figure 2). The two-directional slope and random high and low areas on the field surface preclude effective application of irrigation water.

Field application systems urgently need improvement. This improvement consists of a precision land levelling programme (1) that has been shown to be important to improved water management and increased crop production in both Pakistan and Egypt (2, 3). A levelling service, appropriate system design, and improved water application practices are components of the programme. Crop production improvements through improved practices, better inputs, and effective services are also included. The exact nature of the programme for Somalia is to be developed and defined for the socio-economic and technical conditions of the country. Suggestions are often made that precision land levelling is too expensive. Experience must develop an appropriate programme,

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1) Clyma, W. et al. 1981. Land Levelling. Planning Guide No. 1, Water Management Synthesis Project, Colorado State University, Fr. Collins, 41 pp.
2) Gates, T.K., W. Clyma and T.W. Ley. 1981. Systems Analysis for Improvement of Surface Irrigation. Paper No. 81-2073, Amer. Soc. of Agric. Engrs., St Joseph, MI.
3) El Kady. M., W. Clyma and M. Abu-Zeid. 1979. On-Farm Irrigation Practices in Mansouria District, Egypt. Paper No. 79-2566, Amer. Soc. of Agric. Engrs., St Joseph, MI..

but water saved through improved water management can be used to increase yields on existing fields, or to increase the irrigated area. Studies have shown that precision land levelling is essential to both improved water management and increased crop production.

Field application systems should provide for effective water management, but also it should facilitate crop production. Thus, rows may be added to borders, and ridges may be added when crops are sensitive to inundation of the plant stems. In Somalia, many crops are grown that are sensitive to inundation of the plant stems. Maize, the most prevalent crop, is very sensitive to contact of the plant stems with irrigation water. Thus, effective irrigation of maize should consist of ridges in level basins as is widely practiced in Egypt (Figure 3). Precision-levelled basins, with maize planted to an appropriate stand on ridges, resulted in significant increases in the yield of maize (1). Most vegetable crops also are sensitive to water contact with the stem. Therefore, cultural practices to use ridge plantings is urgently needed for major increases in crop yield in Somalia. Egyptian farmers use hand labor to accomplish primary tillage and form ridges because of the value of ridges in the cultivation of certain crops.

Sesame, in particular, but also a number of other crops, are grown on a single pre-irrigation. This practice consists of building higher than average bunds around a field such that a relatively large area can be flooded, regardless of the land slope and unlevelness of the field. Inundation times of over a month frequently result. This practice may result in a significant deep percolation to raise the water table and also cause increases in soil salinity. The practice needs careful study.

Another practice in one area, and observed to a limited extent in some other areas, is to build bunds of 1 - 1.5 m around large areas (up to 10 - 15 ha) and flood the entire area in a pre-irrigation without any additional internal bunds. Water depths may range from 60 to 90 cm on the low side of the area. No subsequent irrigations are applied, unless a severe drought occurs. This practice may result in serious constraints also.

<u>Water use by crops</u> - A number of constraints to improved crop production exist because of limitations in the understanding of crop water requirements, including how frequently to irrigate a given crop. Many crops are grown in Somalia on a single pre-irrigation. A large amount of water is available from the clay soil, and significant rainfall comes during the two seasons for growing non-perennial crops. However, several crops are grown with only a pre-irrigation when water requirements would normally exceed that available from the soils and rainfall.

Maize, for example, is considered a crop sensitive to water stress, but is frequently grown on residual soil water and rainfall in Somalia. A number of vegetables, including tomatoes and watermelons, were listed as frequently grown without other than a pre-irrigation. Tomatoes, watermelons, and maize are sensitive to inundation by irrigation water. A hypothesis is that farmers have learned by experience that an irrigation does more harm than good because the crops are planted flat.

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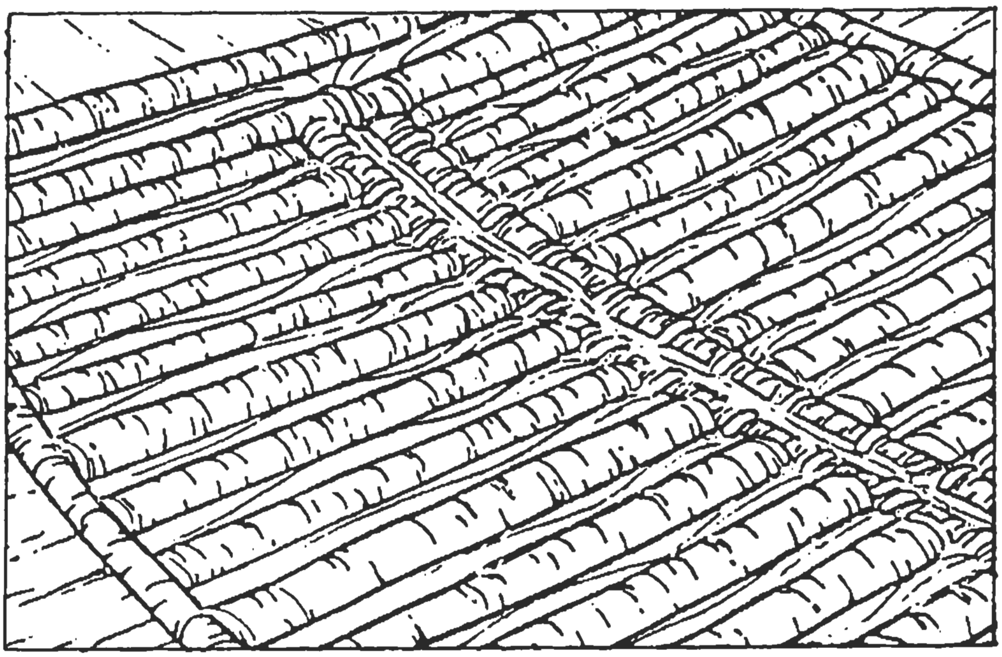
1) Sorial, E. 1980. An Economic Evaluation of Corn Yields. EWUP Staff Paper No. 10.

Figure 3 Level Basins With Ridges as Practiced in Egypt
(El Kady, Clyma, and Abu-Zeid, 1978)



Crop	Top Width	Base Width	Channel Width	Ridge Height	Basin Length	Basin Width
	a cms	b cms	c cms	d cms	L ms	W ms
Squash	70- 85	85-100	18-25	15-20	8-20	3- 8
Tomatoes	60- 90	70-100	20-40	12-18	8-20	3- 8
Cabbage	10- 20	38- 40	30-42	12-22	8-20	3- 8
Eggplant	10- 20	35- 40	18-25	10-20	8-20	3- 8
Watermelon	140-200	200-250	20-25	20-25	15-30	10-20
Corn	12- 20	35- 40	15-25	10-15	5-15	3-12

Every farmer consulted, and most state-managed projects, mentioned fewer irrigations for their crop than expected and most implied a water availability constraint. The heavy clay soils can store large amounts of water. However, they require careful management to prevent salinity accumulations. Frequent leaching must also be done if the soil is sufficiently saline. Water must also be managed to prevent water standing during the heat of the day and causing scalding of crops.

Information is needed on appropriate criteria for pre-irrigations, the frequency of irrigations during the season, and the appropriate amount to apply for replenishing soil water as constrained by soil intake rates. Consumptive use rates can be estimated with necessary accuracy for many management decisions, but crop and soil management for increased crop production needs careful research in Somalia. Management criteria to make efficient use of rainfall is also needed.

<u>Water removal system</u> - Lack of surface drainage for both rainfall and irrigation is a constraint to crop production in many areas. This is caused by the low-intake soils, the bunds around most field areas, and the lack of surface channels to carry off excess water. Low areas in fields and areas at the low end of a bunded area showed effects of excess surface water on crop stand and plant vigor.

Subsurface drainage is already needed in several areas where a high water table and surface soil salinity have caused some areas to go out of production. The very heavy field applications of irrigation water (in some areas in excess of 60 cm) are expected to rapidly create high water table conditions in several irrigated areas. Saline groundwater and naturally saline soils indicate that groundwater levels must be controlled or irrigated land will rapidly go out of production from the high water table and/or salinity.

The best approach to controlling both surface and subsurface drainage needs is to control irrigation applications. In addition, design and management criteria for surface and subsurface drainage should be developed.

<u>Crop production</u> - Irrigation practices for water delivery, application, use, and removal all have-significant effects on crop yield. This area has been neglected and is a major constraint to production in Somalia. Another area that has potential high payoff to increase yields is to define the effects of soil water stress on yield of major crops. This is particularly important because of the prevalent farmer practice of supplying only a pre-irrigation to many crops that are known to be sensitive to stress with significant reductions in yield and quality when stressed. Careful monitoring of salinity should occur in all research, both on the experiment station and in farmers' fields. The potential impact of salinity on yield, and the potential hazard of salinity from soils, groundwater, and a high water table necessitate this monitoring.

Water table effects on yields in Somalia are expected to be severe. Salinity is one reason, but also the fine-texture soil will extend the effect of a water table from a greater depth and will dissipate the effects of poor root zone aeration less quickly. Both can cause major reductions in crop yield.

A range of studies is needed to define interactions and appropriate combinations of practices for water, fertilizer, varieties, plant population, and other factors for less-than-optimum levels of an input, such as fertilizer, or a poor crop stand. Disease and insect control that is less than optimum may have a similar effect.

Tillage practices in Somalia usually involve primary tillage with a one-way mouldboard or disk plow. As a result, each tillage operation continues to destroy the levelness of the field at each deadfurrow and backfurrow formed. Reversible plows are needed if precision-leveled fields are to be provided and maintained. Research is needed on more appropriate methods of tillage for irrigated lands.

The on-farm research programme should carefully investigate the magnitudes of the effects of providing only a pre-irrigation, flat planting, salinity, and a number of other practices on the costs and benefits to farmers. The causes of effects such as salinity should also be investigated. These can be done in a diagnostic analysis format, as well as by comparative studies for cropping seasons.

There is an expected high pay-off to continued research on the factors of production that affect yields in Somalia. Major needs exist to determine effects on yields of the irrigation system, water management practices, tillage practices, and traditional farmer practices. As on-farm research studies continue, other major problems will be identified that will become high priority research needs.

5. Socio-economic Constraints

Organizational constraints exist in the department dealing with irrigation water. Progress is apparently substantial in the area of coordination between research and extension. Personnel are few and they lack experience in a number of areas in each department. All need strengthening.

A monitoring and evaluation cell for action research, and to assist in other areas, is needed to initiate an irrigation water management improvement programme. Performance evaluation of each service unit, such as land and water, extension, and delivery of inputs, would be accomplished early in the improvement programme through a diagnostic analysis study. Results of the study can provide input to defining further organizational needs in the ministry.

Farmer organizations do exist in a number of instances for private efforts to divert irrigation water from the river. These apparently operate successfully, but need assistance to improve performance. Many of the state farms, resettlement schemes, and projects whereby irrigated areas are provided with water, also need various kinds of assistance, but operate organizationally with a paternal/directive type organization. This area also needs improvement.

6. Research Needs and Recommendations

Irrigation water control is an important area in need of water management improvement in Somalia. Three general areas of improvement are urgently needed. The recommendations are as follows:

1. Strengthen and expand the Land and Water Department functions to include the functions for irrigation water control, including water rights, diversions, canal system management, and on-farm water control.

2. Strengthen personnel of the Department through policies that will accomplish recruitment and retention of engineering personnel, and provide on-the-job training to improve capabilities.

3. Initiate an action research effort to improve the management of irrigation water deliveries to accomplish water control, thereby increasing the efficiency and productivity of water.

An on-farm water control service is presently absent from all programmes for irrigated agriculture in the Ministry of Agriculture. This is reflected in the serious deficiencies of unreliable water supplies, inappropriate field irrigation systems, ineffective water use, and lack of surface and subsurface drainage. Farmer knowledge in each of these areas is seriously deficient, resulting in substantial reductions in crop yields and low irrigation efficiencies. The recommendations for improving on-farm water control are as follows:

1. Add the function of on-farm water control to the Land and Water Department.

2. Initiate and evolve improved field irrigation systems through an action research programme.

3. Initiate a research programme to establish for Somalia criteria for appropriate design of needed farm water control technologies, such as precision land leveling, appropriate field irrigation systems, amount and timing of irrigations, and surface and subsurface drainage.

Crop production has a high potential for improvement in Somalia. Research is needed to begin to achieve this potential. Specific areas of high priority research were identified. The recommended areas of research effort were as follows:

1. Establish an on-farm water control research component in the ongoing crop research activities.

2. Emphasize key constraints of farmers in formulating experiment station research, such as water stress, tillage methods, and the costs and appropriate practices for use of less-than-optimum inputs.

3. Initiate an action research programme that systematically defines key constraints, solves problems directly, or feeds information to the other units for action or further research.

Socioeconomic constraints are related to the organizational needs in irrigated agriculture. The recommendations to meet these needs are:

1. Strengthen the Land and Water Department by defining functions and improving personnel.

2. Strengthen programmes of the other departments based on priority constraints and improved personnel.

3. Initiate a monitoring and evaluation cell to implement an action research programme and improve management.

4. Initiate farmer organizations for effective involvement of farmers to improve the management of irrigated agriculture.

A strategy and specific recommendations for improving the management of irrigated agriculture in Somalia are provided in a companion paper titled "An Irrigation Water Management Improved Programme for Somalia".

Acknowledgments

The author of this report wishes to acknowledge the assistance of numerous government officials, expatriate advisors, and farmers in Somalia. Particular appreciation is due Mr. A.N. Alio, Director, Agricultural Research Institute, Ministry of Agriculture; Dr. J.S. Bakshi, Resident Research Advisors and FAO Project Leader; and Mr. Mahmoud M. Ali, Director, Department of Land and Water. All three assisted in various field tours of irrigated agriculture in Somalia and answered many questions. Dr. Floyd Williams reviewed and offered many helpful comments on the various drafts of the paper.

APPENDIX 3

Land Levelling

1. Introduction

Land levelling is recognized as a prerequisite for efficient surface irrigation. Even for sprinkler irrigation a degree of levelling is helpful, although the standards need not be nearly as demanding as for surface flow systems. Precise levelling is of special importance on the soil types that predominate in the Juba valley area: their swelling clay fraction seals all cracks on wetting and slows down infiltration to an extent that will cause the crops growing in these areas to die through waterlogging if submerged for more than a very short time (e.g. in particular maize). The same would apply to rainfed plots where farmers are attempting - as they should - to prevent runoff and try to introduce water from the surrounding areas.

The importance of land levelling is well known to farmers in Somalia and various attempts are being made in all irrigated areas to achieve an acceptable degree of levelling. Unfortunately efforts have not been coordinated. No definition of the desirable slopes within the plots under different soil, crop and irrigation conditions has been made, nor has the permissible deviation from the perfectly levelled fields - which is very difficult to achieve - been determined. The most universally available tool for levelling is the bulldozer, which is at best unsuitable and, as commonly used for bunding (excavating a trench near the bunds it pushes up) actually damaging. It would therefore be desirable to organize a land levelling service. The service would (a) provide the appropriate tools; (b) enable farmers to borrow for this expensive yet rewarding operation; and (c) determine the scientific criteria for levelling, dependent on field layout, soil characteristics and the expected stream size that the farmer will have to handle.

The issue of long-term credit requirements, the prerequisite to enable farmers to apply for it and legislative and administrative actions to enable the process to take place, have been discussed in those sections of the present report dealing with credit and land tenure. The present appendix will discuss appropriate machinery, the criteria to be established for levelling under different irrigation conditions envisaged and the organization that would appear to be appropriate to provide the necessary technical and administrative backup.

2. Appropriate Machinery

Ideally, land levelling should be done with laser-controlled elevating scrapers and similarly controlled graders. However, the use of such equipment may not be appropriate to the envisaged relatively small-scale operation and to prepare fields for border, as opposed to basin irrigation. Also, it will be assumed that the farmers availing themselves to the service will not use large mechanical equipment like combine harvesters: the widest machine envisaged is a scarifier or a shallow-working disk harrow, neither more than about 4 m wide. Thus border strips as narrow as 10-12 m become feasible; making them wider would imply uneconomic amounts of earthmoving.

Therefore the machines for levelling smallholdings would be the towed or rear-mounted grader blade, operated by the commonly available 60-70 HP tractor. Such a rear-mounted blade is in common use in India and Pakistan, costs about US $ 300 and has proved to be very efficient for moving small quantities of soil. Since it is not protected by patent rights, it is feasible to import a few and to have them copied in the Mogadishu Foundry. The estimated cost of the locally-produced machine is not expected to differ much from the price quoted above.

It would however be helpful also to use trailed graders, especially for the initial field levelling operations, before the borders are established. Under these circumstances even landplanes may be considered; landplanes differ from graders by having a much longer wheelbase. This makes their use in small fields cumbersome, but, as stated, may prove to be the right tool during the initial development stage of a farm.

It is understood that purchasing laser-controlled, large-scale equipment is under consideration for the Mogambo and Fanoole Irrigation Schemes. For these large-scale schemes they would be suitable. Their presence would also enable trials to be made, under different conditions, as to their suitability for the kind of work likely to be done on other farms and a decision be made later, whether to purchase additional units or not.

3. Levelling Criteria

As noted, no work has been done in the Juba valley area to determine the standards to which fields should be levelled. Investigations have been confined to Mogambo only. These were, obviously, guided by the criteria of that specific project, where the objective was to prepare fields for the efficient use of large-scale, wide farm implements. While there is no reason to doubt the appropriateness and accuracy of that work, and the recommended parcel sizes arising from it pertaining to the specific conditions in Mogambo and Fanoole, it is of little direct use when determining standards for smallholder farmers who operate under entirely different conditions. It has already been suggested that research in appropriate land levelling criteria would be undertaken in the Bardheere Research Station. The researchers of the station, working with the SMSs in Soil - Water Management, as have been proposed for the extension service in the Juba valley, would determine the most appropriate field layout acceptable to farmers and, within this layout, the desirable longitudinal and cross slopes. This work could initially be done on the Bardheere Research Station, but afterwards a considerable part of this effort should be in farmers' fields. The objective, apart from striving for acceptability by the farmers, would be to minimize the amount of soil that has to be moved, preferably no more than 400m^3 per hectare.

4. Support Services

The land levelling operation must be adequately supported; administratively and technically. Fields must be marked for cut and fill, the operation should be supervised and its progress certified so that the farmer may obtain part of his loan from the lending institutes to pay the tractor owner or to recoup some of his own costs, if he uses his own machine. To perform this task, two-man survey teams are required, trained to use a small computer with the appropriate programme for land levelling; these small computers or programmable calculators are readily available. With suitable office backup cut and fill calculations can then be made, which will have to be marked unmistakably in the field, for the tractor operators to follow. On completion of part or the whole field, the operation must be checked both for accuracy and to certify it for payment. Such support services to land levelling, particularly for irrigated smallholders, could e.g. be given by the proposed irrigation development support organization.

APPENDIX 4

Animal Traction

1. Introduction

The issue of animal traction has attracted considerable attention in Somalia for many years. Several agencies have tried to establish the use of draft animals for tillage operations. Yet the outcome at present is that while donkeys and oxen are regularly used to pull carts in rural as well as urban areas, all attempts over the years have failed to introduce draft animals in the Juba or Shebelli valleys to assist in land preparation and crop maintenance operations. This failure is all the more unexpected because for instance in the North-West, Awdal and Tug Der Regions of Somalia animals are regularly used for farming operations, be it on a diminishing scale, which may conceal a significant message. At present considerable work is taking place at the Bonka Research Station, to develop an aspect of animal traction new to Somalia: the use of donkeys for tillage work. The work expected of donkeys is more in line with the presently perceived needs of heavy self-mulching clay soils; light surface work, while no attempt for deep cultivation of the soil is made. Also, the issue of weeding with animal power is given more emphasis than previously. While it is too early to forecast the likely outcome of this work, it may be of assistance to examine some of the reasons why the introduction of animal traction has failed in the past and how these causes may influence future developments.

2. Possible Reasons for Past Failures

The main reason why animals have not been used would appear to be the fact that most of the agricultural lands in the riverine and inter-riverine areas in Somalia are subject to trypanosomiasis. Even though there are some clear areas, practically all stock must spend at least part of its time near the rivers where the tsetse fly is always present. Even a slight degree of infestation would weaken the animal sufficiently to cause its death, if it worked hard before the Gu season, when the demand is greatest (for land preparation) and the animals' condition the worst. It is significant to note that of the oxen introduced by AFMET in the Jilib and Saakow areas, as part of their campaign to introduce animal traction during the period 1980-86, many have died of trypanosomiasis.

At present, while the control of trypanosomiasis would appear to become easier, and it is expected that in the near future the disease will be brought under control in most of the country, economic factors are increasingly working against animal traction. A study in the North-West and Awdal Region has concluded that only about one third of the farms are worked by animals, the rest by tractors. In the recent past, animal traction was universal. The reason would appear to be that, while then one ox was worth about four or five quintals of sorghum, today one ox that can be effectively used for ploughing costs the equivalent of 15 quintals or more. Clearly, this is too much money to put at risk over a dry season, during which the animal is certain to loose value and may even die. A recent survey in the North-West Region suggested that if more tractors were available, the number of work oxen would decrease even further. It therefore seems unrealistic to expect farmers who have never used oxen for field work to embark on the introduction of animal traction in an area even more unfavourable for a work-stressed animal when even the traditional users are changing. Moreover, and most unfortunately, world-wide experience shows that it is getting more and more difficult to persuade farmers to use animals when the rest of the world is mechanizing. A recent review of the fate of new implements, designed by ICRISAT and other organizations dealing with animal draft, concludes that they are simply not being adopted by traditional animal implement users: they all demand mechanization.

3. Recommended Development Measures

In view of past experiences and considering trends in Somalia and elsewhere, it would seem virtually certain that animal traction for farm work, using oxen, will not succeed. The intending owners would have to purchase additional animals which, as noted, may die on them and would be expensive to keep in the jilaal season. Probably the only likely development is the use of donkeys. Practically every rural household has access to one: they either own some for water carrying or local haulage, or can borrow one. Donkeys are cheap, costing the equivalent of 2-3 quintals of maize or sorghum instead of 15 and since owing a donkey does convey the social prestige on the owner that owing cattle does, it seems more likely that they would lend it more readily. Moreover, the risk of a donkey dying in the dry season is less than for cattle. Also, their feed requirements are far more modest than those of cattle, not only in quantity, but because they are originally animals of the deserts, also in quality. Based on results achieved in Bonka to date, future investigations should identify, design and lead to the fabrication of prototypes of suitable shallow-draft implements that one or two donkeys can pull and that can prepare land adequately for planting. Bonka is also developing donkey-drawn seeders and equipment for interrow cultivation, which could substantially reduce manpower requirements, particularly for weeding, and therefore costs of production.

It will have to be accepted that donkey-drawn land preparation implements will not be able to control infestation with stoloniferous weeds. However, if tractor hire services become available as has been suggested, farmers could then hire a tractor every three or four years for deep ploughing, all the more so since this activity would have to be carried out at a time when tractors would not normally be heavily engaged.

In view of the above it would appear advisable that, after further review of recent work in Bonka on animal traction, the Agricultural Extension Service in the Juba valley be reinforced with a small unit, consisting of a trained operator and one or two donkeys with suitable implements. The unit's task would be to demonstrate the use of donkey-drawn implements of all kind to interested farmers. The extension service should, further, develop a scheme whereby trained donkeys would be exchanged for the farmers' untrained animals. This degree of subsidization, in view of the ease with which donkeys can be trained, would appear to be well justified.

ANNEX 6

S O M A L I A

Masterplan for Juba Valley Development

Market Prospects for Agricultural Produce

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List of Abbreviations

ADC	-	Agricultural Development Corporation
CIF	-	Cost, Insurance, Freight
FAO	-	Food and Agriculture Organization
FOB	-	Free on Board
IBRD	-	International Bank for Reconstruction and Development
MoA	-	Ministry of Agriculture
WHO	-	World Health Organization

Market Prospects for Agricultural Produce

1. Introduction

Ecological conditions in the Juba valley (soils, climate, water availability) would enable the cultivation of a wide range of agricultural produce. Market prospects are one of the criteria to be taken into account when selecting crops in agricultural development planning.

Market outlets for agricultural produce may exist on the national as well as on the international markets. Considering the final destination of present agricultural production, it can be observed that the by far highest portion is absorbed by autoconsumption of the farmers' families, i.e. marketable surplus is low. The main purpose of production in traditional agriculture is to secure the family's surplus with basic foodstuff. In general, only in years with exceptionally favourable weather conditions farmers would be able to sell significant amounts of sesame, maize and sorghum on the local markets. Market production is concentrated in the lower Juba: sugar and rice are produced on the large-scale estates for the supply of local demand, and bananas are grown mainly for exportation.

This structure will not change basically before the commissioning of the Bardheere dam. Even after 1995, although it is assumed that the marketable surplus will increase substantially, the main market outlets for produce from the Juba valley will still be the following:

- supply of basic foodstuff for national consumption, partly substituting imports

- supply of raw material to agro-industries

- supply of exportable produce (mainly bananas) for the international markets.

Considering that the satisfaction of basic food needs is the most important objective of agricultural development policy in Somalia, an attempt will be made to assess demand and supply for such food items, taking as a basis the desirable food intake per capita and comparing it with the supply composed by local production and import. Probable future trends of demand and supply will have to be assessed.

As a second step, historical prices will have to be analyzed and compared with world market prices, and future price developments be forecasted.

As a third step, market prospects for single groups of commodities will have to be assessed. Because of the long-term planning horizon, forecasts are limited to commodities which at present are and in the future will be the major crops in the Juba valley.

Two different planning horizons are taken into account:

- from present up to 1995, this being the probable year of commissioning of the Bardheere dam; no major development in irrigated agriculture will take place during that period due to problems mentioned in above chapters

- the long-term perspectives after 1995, when the dam is in operation. Special emphasis will be given to the probable conditions in the year 1995, as from that point of time onwards substantial increases in agricultural production are expected.

The main obstacle encountered in the analyses of market prospects is the lack of reliable data. Only very little information is available and it is most disturbing that information obtained from different sources is contradictory. Since considerations of market prospects have to be based on historic developments and the present situation, extrapolations lead to considerably different results depending on the data base applied and assumptions defined. Even basic figures like population or the present food basket are not clear. Analyses of historic numerical series easily detected distortions which are unrealistic and cannot be explained.

Therefore, no detailed quantitative estimates for the assessment of long-term market prospects are presented here. Projections are limited to the identification of probable trends and will have to be regularly updated during the development process in the Juba valley.

Because the project will have an impact upon the whole of Somalia's economy, issues concerning sales volumes at national level will be dealt with.

2. Demand for Basic Foodstuff

2.1 Present Situation

An increase in self-sufficiency in food supply in order to meet basic requirements as well as to save foreign exchange through the substitution of imports is an objective of highest priority in Somalia. Therefore some detailed considerations on food requirements are presented in the following.

The population in Somalia can be subdivided into three different groups:

- the group of urban settlers
- the rural settled and
- nomads.

These groups have quite different consumption patterns which have not yet been exactly determined. However, a typical consumer behaviour has been observed.

A high portion of the nomadic consumption consists of animal products. Milk is main food item and consumption of meat is relatively high. Occasionally nomads change animal products for sorghum (and maize), sesame oil and sugar. Consumption of vegetables, legumes and fruit is low.

The main food items of the settled rural population, who are mainly farmers, are cereals (sorghum and maize), vegetable oil, legumes, vegetables, fruit with occasionally some milk and meat in addition.

The diet of the urban population is the most diversified one as they do not produce themselves but must purchase their food. Population groups with higher incomes are able to provide themselves with a well-balanced diet, whereas low-income urban groups depend on inexpensive food items, mainly cereals, cereal products (with a high portion of pasta and bread), vegetable oil and fruit. Consumption of pasta, bread and rice which were introduced through European and Asian influence only a few decades ago, is rapidly increasing. It is now no longer confined to the urban centers but is becoming more and more common in the rural areas as well.

In order to assess the basic food requirements on the national level, the following assumptions are made:

- Total population of Somalia in the base year 1985 is assessed at 6.5 million inhabitants, including the refugees who have been immigrating into Somalia since the border conflict with Ethiopia in 1977 [32].

- The average per capita income in 1986 is estimated at US$ 260 [32].

- The desirable energy intake is 2,195 kcal/cap/day as determined by FAO/WHO [17].

According to the statistics and estimates available, per capita food consumption in Somalia varies greatly from year to year, mainly depending on weather conditions and on the availability of food aid. According to the 1985 IBRD Agricultural Statistics Handbook Somalia, the lowest intake was computed in 1974 with 1,635 kcal/cap/day; the highest in 1985 with 2,099. The average during the period 1980-1985 is 1,868 which may be considered as intake in normal years. Intake in good years, represented by the average of the period 1983-1985, would be 1,988 kcal/cap/day.

Energy values for different food commodities based on information provided by MOA and [9] are taken as follows:

Food item	kcal/100 g
Milk products	72
Meat	185
Cereals, average	350
Legumes	340
Vegetable oil	900
Sugar	390
Others	100

On the basis of the figures published in the IBRD Agricultural Statistics Handbook, an average food basket for the year 1985 can be derived. The overall average per capita intake of energy would have been 2,099 kcal/day. In order to achieve the desirable intake of 2,195 kcal/cap/day, the corresponding difference for each item is added, assuming that the relative composition of the food basket would remain unchanged (see Table 2.1/1).

Table 2.1/1 Actual Average Per Capita Food Basket 1985 and at a Desirable Intake of 2,195 kcal/day

Food item	Actual 1985			At an energy intake of 2,195 kcal/day		
	kg/year	g/day	kcal/day	kg/year	g/day	kcal/day
Meat	26.5	73	135	27.7	76	141
Milk	221.0	605	424	231.0	633	444
Cereals	121.2	332	1,162	127.0	347	1,215
Legumes	1.9	5	17	2.0	5	18
Vegetable oil	4.6	13	117	4.8	13	122
Sugar	12.5	34	133	13.1	36	139
Other	40.6	111	111	42.5	116	116
Total			2,099			2,195

Source: Own estimates on the basis of figures published in [IBRD: Agricultural Statistics Handbook Somalia, Draft, 1985] [25].

The composition of cereal consumption is broken down as follows (information provided by MOA):

- sorghum 27%
- maize 43%
- rice 11%
- wheat 19%.

From the above figures, actual consumption and requirements of food on the national level can be derived. They are displayed in Table 2.1/2.

Table 2.1/2 Somalia - Consumption and Requirements of Food (1985)

Food item	Consumption	Requirements
	in '000 tons	
Meat	172	180
Milk	1,437	1,502
Sorghum	213	223
Maize	339	355
Rice	87	91
Wheat	150	157
Legumes	12	13
Vegetable oil	30	31
Sugar	81	85

2.2 Future Developments of Demand

The main factor influencing future food demand is population growth. Population census figures from at least two different years are not available. The latest growth rate assessed by IBRD of 3.1% per annum is applied here. At that rate, Somalia's population would reach 8.6 million in 1995 and 11.8 million in 2005.

Still leaving aside considerations on the developments of incomes and effective demand, food requirements will increase at the same rate as population. However, the composition of the food basket will have to change. Due to ecological conditions, it appears to be impossible to increase the number of livestock at this rate, at least under the existing holding conditions. At present, there are eight heads of livestock per inhabitant which represents one of the highest ratios in the entire world. The carrying capacity of rangelands is utilized to exhaustion in many areas of the country, in some parts degradation due to overgrazing is evident, mainly in the vicinity of towns, villages and water points. Further increase in the production output of the livestock sector could only be achieved by the introduction of additional means, such as integrated crop production/livestock holding systems and additional feeding. With all respect to the efficient nomadic livestock holding system, it is highly improbable that basic changes would occur rapidly. Therefore, it is assumed that Somalia has reached the medium-term maximum in livestock numbers held under traditional conditions. It is assumed that the output of the livestock sector will not grow by more than 2% per year.

In consequence the portion of non-animal products will gradually increase and partly replace the consumption of milk and meat in the average food basket, representing a calorie intake of 2,195 kcal/day. The calorie intake from the latter group would decrease from 559 to 527 kcal/cap/day by 1995. Assuming that the gap of 32 kcal/cap/day would be proportionally filled by all other items, the basic food requirements in the year 1995, as compared with 1985, would be as shown in Table 2.2/1.

Table 2.2/1 Somalia - Food Requirements at a Desirable Energy Intake of 2,195 kcal/cap/day - 1985 and 1995

Food item	1985	1995
	in '000 tons	
Meat	180	211
Milk	1,502	1,758
Maize	355	477
Sorghum	223	299
Rice	91	122
Wheat	157	211
Sugar	85	114
Vegetable oil	31	42
Legumes	13	17

Note: Other food items like fruit, vegetables, roots and tubers are not mentioned here because of the heterogeneous composition of that group.

The above demand analysis was restricted to the assessment of physical needs without consideration of financial terms, assuming that an average minimum supply of basic food products will in any case find a demand. Although the lack of reliable data makes it impossible to predict exactly the demand patterns to be expected in the future, probable trends can at least be assessed. The conclusions drawn here are assumed to be valid also for the period after the commissioning of the Bardheere dam.

Demand patterns will be influenced mainly by three factors:

- population growth
- economic development (income development)
- the urbanization and sedentarization process.

As mentioned before, population growth is assumed to be above 3% per annum. The growth rate of 3.1% applied here may even be on the conservative side.

Per capita income in Somalia is estimated to be around US$ 260 (1985). A future medium-term growth rate of GDP of 4.1% per annum is thought to be feasible [32], although the vulnerable economy is highly dependent on external factors such as export conditions, oil prices and weather conditions.

Under the above assumptions, the conclusion can be drawn that the increase in demand for all groups of agricultural produce considered here will in no case be lower than the population growth rate.

Present consumption patterns are strongly influenced by the fact that about 55% of the population are still considered to be nomads. Their daily diet depends on the food items immediately available, i.e. milk and meat. The remaining 45% of the population are roughly equally distributed between rural settled and urban dwellers. Although not yet proved by official statistics, an urbanization and sedentarization process is taking place, slowly reducing the proportion of nomadic population [J. Janzen in 8]. This process has been accelerated during the last ten years by the settlement of refugees and people affected by drought, either in camps, in agricultural and fishery settlements or in towns and villages where they try to find a source of income.

As mentioned before, overgrazing in many areas is impeding an increase in the number of livestock. Therefore, the growth of nomadic population can no longer be absorbed by the nomadic livestock sector itself. Each drought provides a fresh boost to the sedentarization process. It is estimated that in 1995 the portion of nomadic population will be reduced in this way to 45-48% of the total. Non-nomadic population will grow at a rate of up to 6% per year.

Although the direction of the sedentarization process has not yet been investigated, it can be observed that nomads on the one hand add to the urban population and on the other settle as farmers in the rainfed areas as well as in the two river valleys.

Nomads migrating to the towns will mostly add to the low-income groups of urban population, i.e. they will depend on cheap food, mainly on cereals. Another increase in cereal demand will be caused by the growing farm population. Within the group of cereals, the preference for wheat products (bread, pasta) and for rice will continue not only in the large urban towns, but, as can be observed, in the rural towns and villages as well. As a conclusion, it is expected that the income elasticity of demand for traditional cereals will be around one; for rice and wheat it will be greater than one.

3. Supply of Basic Food Stuff

3.1 National Production

According to the annual production statistics of the MOA as published in the IBRD Agricultural Statistics Handbook, agricultural production in Somalia suffered serious ups and downs during the 1970's, mainly due to the varying climatic conditions. During the 1980's, a steep increase in the production of cereals, oil seeds, sugar, legumes and vegetables could be observed. This may be attributed to more favourable weather conditions as well as, from 1982 onwards, to the liberalization trend in market policies and the subsequent rise in producers prices. Somalia's crop production has become much more market-oriented, since the farmers are free to sell their produce either to private traders or to Government-owned Agricultural Development Corporation (ADC).

Another source of increase in agricultural production is the development of irrigation projects in the Juba and Shebelli valleys. The implementation of new projects (mainly in the Juba valley) and the rehabilitation of existing schemes (mainly in the Shebelli valley) have contributed to the positive production trend during recent years. Official figures for agricultural production in Somalia are displayed in Table 3.1/1.

Table 3.1/1 Somalia - Food Crop Production 1970-1986

Year	Sorghum	Maize	Rice milled	Wheat	All grains	Sesame	Ground-nuts	Cotton seed	All oil seeds	Edible oil	Beans	Sugar
	('000 metric tons)											
1970	158.1	122.1	2.0	0.7	282.9	43.4	3.0	2.3	48.8	15.1	10.9	50.0
1971	128.7	99.4	1.6	0.3	230.0	35.3	2.5	1.9	39.7	12.3	8.9	45.7
1972	149.1	114.9	2.3	0.6	266.9	41.0	2.9	2.2	46.1	14.3	10.3	41.3
1973	128.4	98.9	2.3	1.0	230.6	35.4	2.5	1.9	39.8	12.3	8.9	37.0
1974	125.7	96.8	2.7	1.2	226.4	34.7	2.4	1.9	39.0	12.1	8.8	32.9
1975	134.7	103.8	3.3	1.2	243.0	37.3	2.6	2.0	41.9	13.0	9.4	33.3
1976	139.9	107.6	3.6	1.2	252.3	38.8	2.7	2.1	43.6	13.5	9.8	36.1
1977	145.1	111.3	5.6	1.2	263.2	40.6	2.8	2.2	45.6	14.1	10.2	41.3
1978	141.1	107.7	8.0	1.2	258.0	40.0	2.8	2.2	45.0	14.0	10.1	32.6
1979	140.0	108.2	8.7	1.2	258.1	40.6	2.8	2.7	46.1	14.3	8.2	21.4
1980	140.0	110.0	11.3	1.2	262.5	38.4	3.0	2.7	44.1	13.7	9.3	29.1
1981	222.0	142.0	12.7	1.0	377.7	53.0	4.0	2.0	59.0	18.3	12.6	26.8
1982	235.0	150.0	13.3	1.2	399.5	57.0	3.2	3.3	63.5	19.7	15.0	34.1
1983	120.0	235.0	2.0	0.3	358.3	60.0	3.0	2.7	65.7	20.4	20.8	30.8
1984	221.1	270.0	2.8	1.3	495.3	46.0	4.7	2.7	53.4	16.6	15.0	39.5
1985	221.0	382.0	10.6	1.3	614.9	60.0	5.0	2.7	67.7	21.0	15.0	39.5
1986	251.3	381.9	11.9	-	645.1	52.4	0.6	2.0	55.0	17.1	12.7	39.5

Source: [28]; Early Warning Department MoA; own calculations.

Note: Part of the figures for 1985 and 1986 are estimates.

3.2 Imports

Until 1975, food imports to Somalia were restricted mainly to items which were not grown in the country: wheat and rice. Other products like vegetable oil, maize and sorghum were imported only occasionally and in relatively small quantities.

Import of food stuff increased substantially in 1975, first in the form of food aid for the drought-affected population and later for the refugees from the border conflicts with Ethiopia. During the period from 1980 to 1984, between 300,000 and 400,000 tons of cereals were imported each year. According to still unofficial figures, this situation has improved during the last two years. The increase in cereal production in Somalia has enabled farmers and the marketing entity ADC to build up stocks which represent more than one year's consumption of maize and sorghum.

Nevertheless, imports of food products still continue. The country has become used to a high level of food aid which represents a significant source of governmental revenues through resales. Although a future without food aid seems to be unrealistic for many, there has been some evidence in recent months that awareness of the possible problems is increasing. Large-scale food aid and other food imports on the one hand and sustained agricultural development on the other are contradictory, at least as soon as the receiving country approaches self-sufficiency in food supply.

In recent months both farmers and Juba Sugar Project representatives gave voice to complaints that they could not sell their produce because the market was inundated with cheap products stemming from food aid and other commodity aid programmes.

Import figures are displayed in Table 3.2/1.

Table 3.2/1 Somalia - Imports of Food Products 1970-1984

Year	Sorghum	Maize	Wheat	Rice	Sugar	Vegetable oil
	(in '000 tons)					
1970	0.5	1.0	31.4	23.3	-	5.3
1971	12.0	27.5	47.7	36.2	-	6.0
1972	-	-	41.7	26.6	16.3	5.5
1973	-	-	20.3	29.8	27.8	4.9
1974	-	11.0	14.3	16.9	13.0	3.1
1975	7.0	50.6	70.2	37.0	13.1	8.7
1976	8.0	51.8	68.0	20.3	22.8	11.1
1977	1.0	23.0	93.8	56.0	52.7	9.0
1978	6.0	15.0	48.3	18.0	67.4	11.4
1979	-	30.0	100.1	79.0	24.5	18.5
1980	-	110.0	91.4	100.0	15.4	12.6
1981	11.0	90.8	200.0	85.0	21.8	19.8
1982	10.0	25.0	180.5	86.0	16.5	26.0
1983	25.0	175.0	125.0	52.0	32.6	29.9
1984	10.0	105.0	155.0	89.1	30.0	28.7

Source: [28] and [29].

4. Prices

4.1 Price Policy and Historical Prices

Agricultural price policy in Somalia was characterized by the principle of benefitting the urban population. Prices for agricultural produce were fixed by the Government at very low levels in order to keep the consumer prices in the urban centers low. This policy could only be maintained through monopoly control of marketing activities. Consequently, private trading of agricultural produce was not allowed, giving the monopoly for marketing of basic food products to the Agricultural Development Corporation (ADC). Farmers were allowed to store only small quantities, fixed on the per capita level, for the family's own consumption.

These regulations not only lead to the establishment of a private parallel market, but also, as a logical consequence, acted as a disincentive for farmers to produce marketable surplus. Agricultural production decreased to a level at which food supply could only be secured through increasing food aid and other food imports.

The situation became so depressed in the early eighties that the Government decided to give up its administered monopoly strategy. Trading was liberalized in 1982 and prices could be established by normal market forces. ADC was converted into a buffer stock holding entity stabilizing the price level through buying activities at a guaranteed price in periods of high offer and selling activities in periods of high demand.

Consequently, between 1983 and 1984, the producers' price level showed a steep increase and from 1985 onwards, crop production went up again.

The system of administered prices has been maintained only for sugar (ENC acting as a monopoly), cotton (SOMALTEX) and bananas (SOMALFRUIT).

Historical price series for agricultural produce are displayed in Table 4.1/1.

Table 4.1/1 Prices Received by Producers

Year	Sorghum	Maize	Rice (paddy)	Sesame seed	Seed cotton	Beans	Sugar	Banana
	SoSh per metric ton							
1981	4,060	2,930	5,730	25,250	6,070	3,170	12,000	1,640
1982	4,010	3,830	7,700	26,520	7,920	3,650	12,000	1,700
1983	4,820	6,330	10,360	26,940	12,720	6,720	12,000	2,450
1984	19,330	25,110	23,450	58,600	18,020	19,110	18,000	4,750
1985	17,000	20,000	26,390	60,000	20,000	20,660	25,000	9,300
1986	13,000	14,000	21,000	50,000	45,000	25,000	35,000	15,000

Source: [25], [56], [76] and SOMALFRUIT. Own field investigations.

4.2 Price Forecasts

Price forecasts are made here for two specific purposes:

- to compare the present and probable future level of prices received by farmers in the Juba valley with the level of world market prices and thus to determine their competitiveness;

- to develop a means of deciding which crops should be promoted for import substitution in the future, i.e. to find out which are the crops with the highest value as compared with the world market prices.

The prices received by the farmers in 1986 (financial farmgate prices) are compared with border parity prices of the same year, computed on the basis of world market prices published by IBRD [31]. This makes it possible to determine the competitiveness of produce from the Juba valley when compared with imported produce. The normal convention to predict future price trends is to use the most recent long-term projections of IBRD as given in the aforementioned publication.

However, in this case, the validity of adopting this approach is limited. Although the comparison of present prices may be quite precise, it can only give a rough idea about possible future trends to be expected. Besides the insecurity of any long-term price forecast, the following considerations have to be taken into account, when basing decisions on the results of the price analyses.

The calculations are made using the prices of 1986 as a basis. If 1985 had been used as the base year, the results would have been totally different, since world market prices were 16.5% lower and actually received farmgate prices in the Juba valley substantially higher (compare Table 8.1/7). Thus, the results may differ considerably from year to year.

For a country like Somalia, with a notorious gap in the balance of payments, the saving of foreign exchange has a very high priority as a national development objective. If the opportunities to earn exchange through exports is low, the country is forced to increase self-sufficiency in the production of subsistence products even at higher costs than the border parity prices.

A certain percentage of higher production costs would be justified anyway for reasons which are not reflected by market prices, such as optimal crop rotations for ecological reasons or maintenance of a sound diversified cropping pattern to satisfy the basic needs of the farmers themselves and, to a certain extent, of the non-farming population.

Even in future periods with the intended high-level development of the Juba valley resources, a major part of the agricultural production sector will be based on a small-scale farm structure with farmers cultivating crops mainly for the autoconsumption of the farm family. Therefore each farmer's crop selection will be dominated much more by the nutritional needs of the farmer's family than by world market prices.

Therefore, the relative importance of the border parity prices as displayed in following Tables should be kept in mind. The quantitative results alone are by no means clear indicators as to the Government agricultural development policy or for decisions to be taken in the field of foreign trade policy. They show probable trends and have to be applied together with a series of other factors.

The following assumptions have been made for the calculation of border parity prices:

- Harbor fees are given as 3% of CIF-value of an imported commodity.

- Agency fees, unloading, storage and transport to warehouse sum up to SoSh 2,720 per metric ton.

- Transport costs from the Juba valley to Mogadishu are calculated on the basis of SoSh 6/ton/km multiplied by an average distance of 450 km (for sorghum 500 km have been taken as a distance because it is grown in remoter areas with poor access).

- The official value of the Somali Shilling (SoSh) has shown a downward trend in the second half of 1986, from SoSh 50 to SoSh 90 for US$ 1. At the same time, the free market rate decreased from about SoSh 80 to 160 per US$ 1. In order to take into consideration the scarcity value of foreign exchange in the Somali economy and to apply a realistic rate which would have to be paid on a commercial basis, an exchange rate of SoSh 130 per US$ 1 is applied here for the year of 1986.

- Import duties are not considered because they constitute a political instrument to influence foreign trade and would as such be fixed according to the priorities set by the Somali Government.

- Sales taxes to be paid by the farmer (5% of farmgate price) are included in the 15% marketing costs.

Table 4.2/1 Border Parity Price for Maize - 1986

US No. 2 yellow FOB Gulf Ports	US$	88
Quality premium 10% (1)	+	9
Insurance and freight	+	60
CIF Mogadishu	=	157
Equivalent to:	SoSh	20,410
Harbor fees	+	612
Port handling	+	2,720
Landed value	=	23,742
Importers costs 5% of CIF	+	1,021
Value at Mogadishu warehouse	=	24,763
Transport Juba valley to Mogadishu	-	2,700
Marketing costs 15% of farmgate value	-	2,870
Farmgate value	=	19,193
Say	SoSh	19,200

1) Given the preference for local varieties.

Table 4.2/2 Border Parity Price for Sorghum - 1986

US No. 2 Milo Yellow FOB Gulf Ports	US$	82
Quality premium 10% (1)	+	8
Insurance and freight	+	60
CIF Mogadishu	=	150
Equivalent to:	SoSh	19,500
Harbor fees 3% of CIF	+	585
Port handling	+	2,720
Landed value	=	22,805
Importers costs 5% of CIF	+	975
Value at Mogadishu warehouse	=	23,780
Transport Juba valley to Mogadishu	-	3,000
Marketing costs 15% of farmgate price	-	2,700
Farmgate value	=	18,080
Say	SoSh	18,000

1) Given the preference for and higher nutritive value of local varieties.

Table 4.2/3 Border Parity Price for Rice - 1986

Thai Milled white 5% broken FOB Bangkok	US$	210
Quality discount 7.5% (1)	-	16
Insurance and freight	+	60
CIF Mogadishu	=	254
Equivalent to:	SoSh	33,020
Harbor fees 3% of CIF	+	990
Port handling	+	2,720
Landed value	=	36,730
Importers costs 5% of CIF	+	1,651
Value at Mogadishu warehouse	=	38,381
Transport mill to Mogadishu	-	2,700
Marketing costs 15% ex-mill price	-	4,650
Value ex-mill	=	31,031
Paddy equivalent 65%	=	20,170
Transport project to mill	-	400
Farmgate value	=	19,770
Say	SoSh	19,800

1) Assuming processing at the new rice mills.

Table 4.2/4 Border Parity Price for Sugar - 1986

FOB Caribbean Ports	US$	133
Quality discount 10% (1)	-	13
Insurance and freight	+	60
CIF Mogadishu	=	180
Equivalent to:	SoSh	23,400
Harbor fees 3% of CIF	+	702
Port handling	+	2,720
Landed value	=	26,822
Importers costs 5% of CIF	+	1,170
Value at Mogadishu warehouse	=	27,992
Transport factory to Mogadishu	-	2,700
Marketing costs 15% of ex-factory value	-	3,300
Ex-factory value	=	21,992
Say	SoSh	22,000

1) White imported sugar is preferred to light brown sugar from Juba factory.

Table 4.2/5 Border Parity Price for Cotton - 1986

Lint CIF Europe middling (1-3/32")		
Equivalent to CIF Mogadishu	US$	1,058
Equivalent to	SoSh	137,540
Sales tax 5% of CIF	+	6,877
Port handling	+	2,720
Harbor fees 3% of CIF	+	4,126
Landed value	=	151,263
Transport to Balacad	+	2,200
Importers costs 5% of CIF	+	2,691
Value at textile factory	=	156,154
Ginnery costs	-	5,000
Value at ginnery	=	151,154
Seed cotton equivalent 33%	=	49,881
Transport project to Balacad	-	5,400
Marketing costs 15% of farmgate value	-	5,784
Farmgate value of seed cotton	=	38,697
Say	SoSh	38,700

Farmgate prices received in 1986 are now compared with border parity prices in Table 4.2/6. Future changes in world market prices as forecasted by IBRD are shown in Table 4.2/7.

Table 4.2/6 Comparison of Prices Received and Border Parity Prices (1986)

	Price received	Border parity price
	in SoSh/ton	
Maize	14,000	19,200
Sorghum	13,000	18,000
Rice (paddy)	21,000	19,800
Sugar	35,000	22,000
Seed cotton	45,000	38,700

Table 4.2/7 Future Changes in World Market Price (according to IBRD Price Forecasts) (2)

	1986-1990	1990-1995	1995-2000
		in %	
Maize	+26	+2	+3
Sorghum	+29	+1	+3
Rice	+17	+2	+2
Sugar	+90	+14	+5
Cotton	+44	+28	+1
Edible oil (1)	+33	+24	-7
Bananas	+4	-4	-4

Source: [31].

1) Since IBRD gives no forecast for sesame oil, the prices of soybean oil are taken here for reference.
2) All changes are estimated on the basis of 1986 constant prices.

No world market prices are available for sesame, beans, fruits and vegetables, therefore no comparison is possible. For sesame oil, the price forecasts of soybean oil have been taken here as a reference, soybeans being a potential crop for replacing a portion of sesame on the national market.

Banana prices for exports are separately dealt with. The farmgate price paid in 1986 by Somalfruit was SoSh 15,000/t, or US$ 115/t. FOB-price Kismayo (export harbor) was US$ 300, i.e. the farmers received 38.5% of the FOB-price, if the free market exchange rate is applied. On the other hand, the farmers obtained inputs imported and supplied by Somalfruit at the official exchange rate of SoSh 90 per US$ 1. Thus, the real share of the farmers was between 38.5 and 50% of the FOB-price, depending on the inputs purchased from Somalfruit.

The Homboy Feasibility Study [76, p. F4-11] quotes that in recent years the farmgate price has represented about 50% of the FOB-price Kismayo, the other 50% constituting costs for services (administration, finance, technical assistance, quality control and inspection), export (harbor fees, shrinkage, port handling, transport to the port, operation of packing stations, costs of banana cartons) and reasonable profit.

5. Market Prospects for Single Commodities

5.1 Cereals

Comparing cereal requirements as assessed in Section 2.2 with national production figures from Table 3.1/1, it can be concluded that Somalia has become more than self-sufficient in the supply of traditional cereals. According to information provided by the Early-Warning Department of MoA in 1987, the country has been able to compile reserve stocks of more than 600,000 tons, representing more than one year's local consumption.

On the other hand, surplus production of traditional cereals is at present by far overcompensated by the deficit in the national supply of wheat and rice. Production conditions for wheat are unfavourable. Rice is successfully grown in the country, but production figures are still far below requirements. Production statistics from former years seem to be somehow distorted. After a steady increase from 2,000 tons in 1970, up to 13,300 tons in 1982, official figures show an abrupt fall to only 2,000 tons again in 1983, followed by a steep increase to 10,600 tons in 1985 (see Table 3.1/1). The upward trend during recent years can be easily explained by the initiation of rice cultivation on the Fanoole and Mogambo schemes, but no rational explanation can be found for the very high production figures during the early eighties and the decline in 1983. There is some evidence for an overestimation of production in former years, whereas the figures from 1983 onwards are considered to be realistic because of the start of systematic data collection through the Early-Warning Department of MoA.

Imports of cereals, be it on a commercial basis or through food aid, showed an increasing trend until the early 80s. Although imports of traditional cereals may have somewhat declined since (official figures are not yet available), the demand for wheat and rice can be met only by increasing imports.

Until 1995, a balance between supply and demand of the traditional cereals sorghum and maize is foreseeable, if weather conditions are not extremely bad. Maintenance of reserve stocks will be possible. After the steep increase in 1983/84 and the peak in 1985, prices for sorghum and maize declined in 1986. It can be expected that as a normal reaction, production will decline or at least stagnate during the next years. Assuming that imports of traditional cereals would be totally stopped, and imports of wheat and rice be permitted on a commercial basis only, an increase in the demand for maize and sorghum of around 4% per annum would allow a similar increase of production in the medium and long term.

Assuming that sorghum production would fall back to around 225,000 tons and maize production to 350,000 tons in 1988, and that afterwards it would increase again by 4% per annum, sorghum production in 1995 would be 300,000 tons and maize production 465,000 tons.

After 1995, market prospects for maize and sorghum will be stable; an annual demand growth rate in the order of the population growth rate, i.e. between 3.0% and 3.5% will have to be satisfied by local supply. Since by then an extension of production area in the Shebelli valley will no longer be possible, most of the additional demand will have to be met by increasing cultivation of sorghum in the inter-riverine area and of maize in the Juba valley.

Different from the traditional grains, there will be a large gap in the supply of wheat and rice. Although wheat cultivation trials are carried out in the Shebelli valley, it is assumed that Somalia will in future have to import almost all of its wheat requirements.

Future rice production will be influenced mainly by the progress of implementation of the two large-scale projects Fanoole and Mogambo in the Lower Juba reaches.

The Mogambo Project has developed 2,200 hectares of irrigated land, but in 1986 only 660 hectares of paddy rice were harvested (360 in Gu- and 300 in Der-season). Average yield was 2.8 tons of milled rice per hectare, resulting in an annual production of 1,850 tons. Plans are such that in 1989 an area of 2,050 hectares would be cultivated with rice with a harvesting intensity of 100%. Yields would slowly increase to four tons per hectare. Implementation of project phase II would start in 1991, the first 500 hectares being under cultivation in 1993, adding another 500 hectares per year in 1994 and 1995 each.

In 1986, 16,000 hectares were developed on the Fanoole scheme, but rice cultivation took place on only 600-650 hectares per season only. An increase of 250 hectares per year would appear to be possible, resulting in a cultivated area of 3,000 hectares in 1995. The present relatively high yield of four tons per hectare of milled rice would be maintained.

It is assumed that rice production in other parts of the country (Lower and Middle Shebelli regions) would increase at a moderate rate (350 to 175 additional tons per year).

Thus, production projection of milled rice on the national level would be as shown in Table 5.1/1.

Under the aforementioned assumptions, the deficit in the supply of rice would rise from around 80,000 tons in 1985 to 90,000 tons in 1995.

As can be seen from Table 4.2/6, the 1986 farmgate prices for maize and sorghum were lower than the border parity prices. The future trend of the world mar- ket prices shows an increase by 1990 of 26 and 29%, respectively. After 1990 prices would almost remain stable. Prices on the national market were low in 1986 as compared to 1985 (and, as yet unofficial figures show, in comparison to 1987, too). Thus a similar trend can be expected for maize and sorghum prices in Somalia.

Table 5.1/1 Somalia - Production of Milled Rice - Extrapolation until 1995

Year	Mogambo	Fanoole	Other regions	Total
1987	4,500	4,000	3,000	11,500
1988	5,760	5,000	3,350	14,110
1989	6,970	6,000	3,675	16,645
1990	7,175	7,000	3,850	18,025
1991	7,380	8,000	4,025	19,405
1992	7,585	9,000	4,200	20,785
1993	9,290	10,000	4,375	23,665
1994	11,495	11,000	4,550	27,045
1995	14,200	12,000	4,725	30,925

Source: Own estimates based on information provided by the management of the Fanoole and Mogambo Projects.

From the above, it can be concluded that from the point of view of market prospects there is a steadily increasing production potential for maize and sorghum in the Juba valley. Land reserves for an increase in sorghum production are available in the rainfed area between Bardheere, Dinsor and Saakow; maize can be additionally grown on newly emerging irrigation schemes as well as on the remaining rainfed areas in the Lower Juba reaches.

The upward trend in rice prices on the world market will be somewhat lower than the ones predicted for maize and sorghum. Under consideration of the rapidly increasing demand for rice in Somalia, it is expected that prices on the national market will increase faster than on the world market. Thus market prospects for rice are very promising. An amount of 90,000 tons represents the production of around 30,000 hectares of irrigated rice land. In the long run, assuming an income elasticity of greater than one, a demand increase of more than 4% per year can be predicted.

5.2 Oil Crops

Sesame is the main oil crop grown in Somalia. Sesame oil covers more than 95% of edible oil consumption from local production, the remainder being extracted from cotton seed and groundnuts. Production of sesame seed has shown an overall upward trend over the last few years, although not as much accentuated as the upward trend for cereals. Price liberalization in 1982 affected sesame as well, but producers' reaction was relatively weak.

The country is still far from self-sufficiency in the supply of edible oil. Import figures show a steady upward trend and 50-70% of vegetable oil requirements are covered by imports. Since cultivation of sesame is bound to the cultivation of maize through its typical crop cycle, the trend of future production is assumed to be similar to that of maize. An annual increase of

4% starting from 55,000 tons as the average production of the period 1982-86, would bring production up to 78,000 tons in 1995. At an extraction rate of 35%, production of edible oil would then be 27,400 tons. Demand would have increased by 1995 up to 42,000 tons, leaving a deficit in supply of almost 15,000 tons, equivalent to 43,000 tons of sesame seed. Assuming an average yield of 600 kg per hectare, this would represent the sesame seed production of 72,000 hectares.

Therefore, market prospects for sesame are very promising. Since demand will be much higher than local production, the relatively high farmgate prices (47,000 SoSh per ton in 1986) will even increase. Table 13 shows that a significant rise in the world market price for soybean oil is forecasted by 1995. This trend supports the assumption that sesame prices on the national market will show an upward trend at least until 1995. In view of the large supply deficit thereafter, it is expected that farmgate prices would even continue to increase beyond 1995, although a slight decrease is forecasted for the world market price of soybean oil.

Seeing the high demand and favourable price forecasts on the one hand and the limited extension potential in the Shebelli valley on the other, sesame production constitutes one of the most promising potentials for future agricultural development in the Juba valley. As even in the long run an additional production area for sesame of 72,000 hectares will certainly not be developed in Somalia, any realistically achievable increase in sesame production in the Juba valley will not be constrained by the absorption capacity of the market.

Perspectives for the production of other oil crops are not easy to predict. In spite of quite favourable market prices, the cultivation of groundnuts in Somalia is low, too heavy soils being the main constraint for a substantial increase in production.

Although production trials for soybeans in the Bay Region and in the Mogambo Project have proved to be quite promising, a considerable extension of soybean cultivation is not expected to take place during the next years. The consumers' preference for sesame oil is such that other oils would only be accepted at much lower prices.

5.3 Sugar

National demand for sugar in 1985 is estimated to be 85,000 tons.

Until the late 1970's, sugar cane was almost exclusively grown on the Jowhar Sugar Estate in the Middle Shebelli Region. Due to the declining soil quality and the obsolete equipment of the sugar factory, production decreased from 50,000 tons of raw sugar in 1970 to 26,000 tons in 1979. As soon as the Juba Sugar Estate and Factory started producing, the trend in national production went upward again, but production is still below the level of 1970. Production conditions are still far from being satisfactory. Major bottlenecks, causing sub-optimal yields, have been the lack of irrigation water during the dry seasons, lack of fuel for the irrigation pumps, difficulties in importing spare parts and consumables for the factory and transport equip- ment. A part of the project area was destroyed by the high floods in 1981.

In 1985, the Juba Sugar Project was producing 39,000 metric tons of raw sugar. After a decrease in 1986, due to the lack of fuel and low water flows in the Jilaal season, it is assumed that in 1987 the output of the factory will be 42,000 tons under normal production conditions. The entire area of project phase I (7,200 hectares) is now under production. Due to low water flows in the Juba river during the first months of the year, an extension of the planted area will not be possible until the commissioning of the Bardheere dam. It is assumed that with growing experience, increasing yields will bring up production to 50,000 tons in the year 1995. The future maximum output of the project, based on the cultivation of cane on 13,500 hectares, would be around 90,000 tons.

Future perspectives of the Jowhar Estate are still unclear. Since 1984 production has virtually stopped. A major investment input for a rehabilitation of soils and of the factory is required. The economics of such a programme are doubtful.

Import figures for sugar demonstrate that Somalia is still far from being self-sufficient. In 1983/84, around 39,000 tons were produced locally, and 30,000 to 32,000 tons were imported. The expected output of 50,000 tons from the Juba Sugar Project will cover less than 45% of the national demand in the year 1995.

In comparison to the world market price, retail prices paid in Somalia are quite high. The ex-factory price, fixed by the Government, represents only about one third of the retail price, i.e. two thirds of the retail price are absorbed by taxes, marketing costs and profits. IBRD price forecasts predict a considerable rise in the world market price for sugar by the year 2000. A regular supply of irrigation water and energy for pumping would increase the present relatively low yields of the project, i.e. costs per ton of raw sugar would decrease. Thus the economic price of sugar from the Juba would come close to the border parity price, rendering sugar production highly desirable.

The future supply deficit estimated to be 64,000 tons of raw sugar in the year 1995 represents the production of about 9,200 hectares of sugar cane. Even assuming that the Jowhar Sugar Estate would be partly rehabilitated, most of that area would have to be found in the Juba valley. Market prospects will not constitute a constraint for the future envisaged expansion of the Juba Sugar Estate to up to 13,500 hectares.

5.4 Cotton

Locally produced seed cotton is processed at the textile industry at Balacad, around 40 km north of Mogadishu and, to a lesser extent, at the Multifabrics Ltd. factory in Mogadishu. The textile factory at Balacad is run by the government owned company SOMALTEX which is functioning under the Ministry of Industries. The capacity of the plant allows the production of 20 million yards of fabric per year, if working on the basis of three shifts per day. Taking two shifts as a realistic basis, the factory would need about 2,100 tons of lint per year, equivalent to 6,300 tons of seed cotton.

Official statistics (see Table 3.1/1) give a production figure for seed cotton of 2,700 tons for the year 1985. However, according to SOMALTEX, the company did not buy any cotton on the local market in that year. The price offered in 1985 was 25 SoSh per kg at the collecting points which was evidently not attractive enough for the farmers. In 1986, the price was raised to 45 SoSh, and in 1987 to 50 SoSh per kg. As a consequence, farmers increased cotton production. In 1986, SOMALTEX was able to buy about 1,650 tons of seed cot- ton and, according to preliminary estimates, about 2,700 tons in 1987.

Multifabrics is producing mainly military textiles. Their demand of local cotton is about 750 tons of lint per year, equivalent to 2,250 tons of seed cotton, thus total demand of the cotton processing industry in Somalia is around 8,500 tons of seed cotton.

The farmgate price paid in 1986 was about 15% higher than the border parity price. This can be explained by the shortage of foreign exchange on the one hand and the prevailing low yields of cotton production on the other. The lack of foreign exchange impeded the industry to import significant quantities of raw material. At an estimated average yield of 120 kg per hectare, the farmgate price of 50 SoSh per kg is even still to low as an incentive to farmers.

According to information provided by the management of SOMALTEX, the demand for cotton fabric in Somalia is such that they do not foresee any problem of selling the output of two shifts. Only a very small portion of the existing demand can at present be satisfied from national production of fabric. Imported textiles are often a blend of cotton and synthetics or even pure synthetics, whereas the demand shows a clear preference for pure cotton materials.

Forecasted world market prices for cotton show an accentuated upward trend in the near future (see Table 4.2/7). Assuming that cotton cultivation under irrigation is more profitable than under rainfed conditions (average yields would be 1,200 kg per hectare), increasing prices would be an incentive for the farmers to include much more cotton in their cropping patterns.

In order to satisfy the existing demand of 8,500 tons of seed cotton, about 7,100 hectares of irrigated land would have to be brought under cotton cultivation. In some areas, yields under rainfed conditions are high enough to render cotton production profitable in mixed cropping systems together with maize and legumes (e.g. in the area between Afgoi and Uanle Uen). Assuming that up to 20% of the supply would be produced under rainfed conditions, still about 6,000 hectares of irrigated land would be necessary to produce sufficient raw material (including cotton seed and losses).

Considering the relatively high transport costs of seed cotton from the Juba valley to Balacad, the construction of a new ginnery there (the old one in Jamaame is obsolete) would have to be considered if a substantial expansion of cotton cultivation in the Juba valley is realized.

5.5 Bananas

Special consideration has to be dedicated to the market prospects of bananas which during the last decades have been Somalia's only agricultural export commodity of major importance. Since the decrease in livestock exports due to the cattle ban in Saudi Arabia even more emphasis has been given to the export of bananas.

Due to political-colonial circumstances the destination of Somali bananas has always been the Italian market, where sales were promoted by special preferences. Until 1972, Somalia's banana exports increased steadily. The Italian market absorbs about 300,000 tons of bananas per year (see Table 5.5/1).

Table 5.5/1 The Italian Market for Bananas (Annual Averages)

Year	Imports ('000 tons)	Per capita consumption (kg)
1970-72 (average)	328.7	6.1
1973-75	325.1	5.9
1976-78	306.6	5.4
1979-81	311.7	5.5
1982	330.0	5.8
1983	304.8	5.3
1984	309.4	5.3

Source: [76], ANNEX 2, p. 3-4.

The other potential market for bananas from Somalia is the Middle East, mainly Saudi Arabia and the Gulf States. After a certain decline during the oil crisis in the 1970's, the demand in that region has been stabilized at slightly above 250,000 tons per year as is shown in Table 5.5/2.

The markets of Iran, Syria and Iraq have declined almost to zero in recent years due to the Gulf War. In normal periods of peace, they would constitute another promising market. Rapidly rising imports during the period before the war reflected the existence of considerable demand for bananas in those countries.

Table 5.5/2 Middle Eastern Banana Imports, 1981-1984

Country	1981	1982	1983	1984
	('000 tons)			
Saudi Arabia	138.0	145.7	147.0	154.0
Kuwait	30.0	35.0	35.0	12.3
Yemen Arab Republic	29.5	32.5	17.6	-
Oman	35.0	15.0	16.0	16.0
Emirates	21.1	5.0	5.0	-
Others	34.0	31.0	30.0	30.0
Total	287.6	264.2	250.6	258.3

Source: [76], ANNEX 2, p. 3-5.

Commercial production of bananas in Somalia was initiated about 60 years ago, when the Italian Government gave special support to its colonialists in Somalia and especially in the Juba valley. Due to political reasons, Italian farmers abandoned the country during the 1970's and left a serious shortage of skills and experience. As a consequence, exports declined from 134,000 tons in 1972 to a minimum of 34,000 tons in 1981. Aggravating factors were the disastrous floods of 1977 and 1981, the acute shortage of foreign exchange impeding imports of necessary inputs and a general decline in banana consumption in the entire world.

In 1983, an Italian/Somali joint venture, SOMALFRUIT, took over the responsibility for input supply, packing, transport, exportation and partly production and technical advice. The result has been a re-increase in cultivated area from 3,200 hectares in 1980 to more than 6,000 hectares in 1987. Export figures went up in 1982/83, but decreased again in 1984/85.

The reason seems to be the extraordinarily low flow in the Juba river during Jilaal season in both years as well as the flood in 1985 which destroyed some plantations and hampered growth on others. Lack of water on the one hand and flood hazards on the other are constraints which are impeding a further major extension of banana plantations in the Juba valley before the commissioning of the Bardheere dam.

Somalia enjoys preferential treatment of its exports on the European markets, i.e. it is exempted from the 20% tax levied on imports from non-preferential countries. Somalia's share in the Italian 300,000 ton market was 24% in the early 1970's. By 1984, that portion had declined to only 6%. Since no quota system is applied in Italy for bananas from Somalia, it would be relatively easy to regain the former position, if a corresponding quantity were available at competitive prices.

According to information obtained from SOMALFRUIT, a problem for market extension is the strong position of only a few trade companies who dominate the world trade of bananas and make entry for any newcomers extremely difficult.

Nevertheless, SOMALFRUIT forecasts that in the short term a combined potential of 137,000 tons exists on the Italian (72,000 t) and Arabian (65,000 t) markets. With Somalia's competitive position in the Middle East market, the preferential status on the Italian market, with improved productivity resulting in lower FOB prices and improved quality, it would be feasible to achieve a higher share in both markets. Thus in the long run up to 200,000 tons of bananas per year are assumed to be exportable.

According to SOMALFRUIT statistics, exportable yield per hectare in the Juba valley was 10.1 tons in 1985. Per hectare production and quality are highly dependent on inputs used and farmer's skills. Assuming that both factors will improve in the near future, an exportable yield of 12 tons per hectare should be achievable. Another factor hampering the production results is the limited availability of good quality irrigation water. Until 1995 there will be water shortages during Jilaal season and, moreover, water is also too saline at that time. With the Bardheere dam functioning it is assumed that sufficient water of good quality would be available. Exportable yields per hectare would increase to 17 tons.

Forecasted world market prices for bananas show a slight decrease by the year 2000. After 1995, when regular water supply is secured, productivity of banana cultivation in the Juba valley should be significantly better than at present, i.e. the aforementioned advantages of Somali bananas on the markets in Italy and in the Middle East should secure their competitiveness as compared to produce from Central America and the Philippines.

Given the water shortage in the Shebelli, at least half of the exports will have to originate in the Juba valley. The net cropped area would then have to be around 5,900 hectares; 25% would have to be added as fallow land and another 10% for roads, drains, and waterways. The overall banana area in the lower Juba valley would then have to be 8,100 hectares.

On the local market, the price for bananas will be mainly determined by the success in increasing exports. Only a portion of around 50% of the bananas harvested are of exportable quality, the remainder being offered on the local market. The more the country is able to export, the more produce will be available for the local market, even assuming that quality of the produce would improve and thus the portion of exportable bananas would grow. Increasing quantities of export rejects will be absorbed by the local market at decreasing prices only.

ANNEX 7

S O M A L I A

Masterplan for Juba Valley Development

Livestock

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Livestock

1. Present Stage of Development

1.1 Livestock in Somalia

The nomadic and semi-nomadic livestock system is Somalia's main economic activity offering means of livelihood for 50 - 60% of the national population. Livestock also provides about 35% of the GDP and more than 80% of the country's export earnings.

In spite of temporary disturbances the system has proven its efficiency and steadiness over many years. There are three established systems of livestock production.

Traditional nomadic pastoralism requires a high degree of spatial mobility in order to avoid unfavourable conditions leading to stock disease incidence and mortality, and in order to derive maximum advantage from available water and grazing resources. Nomadic livestock producers generally prefer a mixed land composition, which allows them to make better use of different grazing and browsing vegetation and its seasonal changes. Livestock production is considered to satisfy the needs for milk, meat, transport, cash income and as a means of (financial) security.

The agro-pastoral system has been established more recently. It has two different origins. Either former nomads keeping a great number of livestock carry out marginal crop cultivation engaging only part of the family, or pure agriculturalists keep a few domestic animals whereby crop cultivation remains the main source of income. The system is not stable and in both cases the "newly achieved" activity may be increased or decreased according to the economic situation of the family.

In and nearby bigger villages or towns a specialized urban and peri-urban dairy and poultry production system has developed. It refers to zero-grazing having little or no linkage to farmland or grazing grounds, and all the feed has to be purchased on the local forage and by-product markets throughout the year. In Mogadishu about 30-40% of the consumed fresh milk is provided by these producers. Smaller and bigger poultry farms are commonly operating on the outskirts of the towns.

Besides the three systems belonging to the private sector, a few Government or municipality-owned farms and production units still exist; there is a tendency towards privatization of these units.

Livestock producers generally prefer a mix of species which allows them to make better use of vegetation by taking advantage of various feeding habitants, variations among species in biological coefficients and tolerance to drought.

In contrast to nomads, settled farmers practice animal husbandry in conjunction with crop production in limited areas of Somalia. Farmers tend to keep lactating cattle, a few sheep and goats near their homes, while non-lactating animals are herded, further away in a manner similar to the herding of nomadic stock.

Table 1.1/1 indicates total Somali livestock population, production (offtake) and officially recorded export figures over the last 15 years.

Table 1.1/1 Somali Livestock Production and Use

	Camel	Cattle	Sheep	Goats	Total	TLU
1970						
Population ('000)	5,200	4,050	9,200	14,800	33,250	11,880
Offtake %	1.5	7.5	24.8	24		
Offtake ('000)	78	30.3	2,282	3,552		
Export ('000)	26	45	546	605		
1975						
Population ('000)	5,424	3,880	9,000	15,000	33,304	12,023
Offtake %	1.6	9.2	21.6	14		
Offtake ('000)	87	357	1,944	2,100		
Export ('000)	33	39	793	743		
1980						
Population ('000)	5,800	4,358	10,300	17,000	37,458	13,176
Offtake %	1.8	9.8	27.3	22		
Offtake ('000)	104	427	2,812	3,740		
Export ('000)	21	85	829	739		
1981						
Population ('000)	6,014	4,473	10,800	18,000	39,287	13,672
Offtake %	1.8	11.4	25.6	21		
Offtake ('000)	108	510	2,765	3,780		
Export ('000)	15	116	701	787		
1982						
Population ('000)	6,239	4,574	11,580	19,000	41,393	14,204
Offtake %	1.8	11.8	23.3	21		
Offtake ('000)	112	540	2,698	3,990		
Export ('000)	15	157	730	719		
1983						
Population ('000)	6,131	4,201	11,200	18,000	39,532	13,638
Offtake %	1.3	9.5	21.5	21		
Offtake ('000)	80	399	2,408	3,780		
Export ('000)	8	44	559	557		
1984						
Population ('000)	6,162	4,296	11,800	18,300	40,558	13,841
Offtake %	1.4	8.8	21.4	21		
Offtake ('000)	86	379	2,525	3,843		
Export ('000)	4.2	8	367	367		

Table 1.1/1 (cont.) Somali Livestock Production and Use

	Camel	Cattle	Sheep	Goats	Total	TLU
1985						
Population ('000)	6,211	4,229	11,893	18,445	40,778	13,870
Offtake %	1.5	10	24	23		
Offtake ('000)	93	398	2,819	4,242		
Export ('000)	7	42	709	749		
1986						
Population ('000)	6,260	4,364	11,987	18,590	41,201	14,061
Offtake %	1.5	10	24	23		
Offtake ('000)	94	436	2,877	4,276		
Export ('000)	9	56	567	567		
1987						
Population ('000)	6,309	4,398	12,082	18,737	41,526	13,789
Offtake %	1.5	10	24	23		
Offtake ('000)	95	440	2,900	4,310		
Export ('000)	20	50	583	582		

TLU = Tropical Livestock Unit

As Table 1.1/1 shows, over the last 15-year period livestock numbers have increased at an average annual rate of little more than 1% which seems typical for a nomadic production system under relatively frequent drought conditions. Future growth rates will depend on human population increase, (export) marketing opportunities, range conditions and on achievements from ongoing or scheduled development measures. Continued growth would most probably lead to general overstocking and declining quality of marketable stock, levelling animal population would be a condition for a more favourable production pattern allowing better offtake of good quality livestock for domestic and export markets (see Figure 1.1/1 - Livestock Development and Use).

Export of cattle, during the given period, has not developed satisfactorily:

- 1982, about 29% (157,000 out of 540,000) went for export, while
- 1987, only about 11% (50,000 out of 440,000) have been exported.

Camel export numbers have considerably risen in 1987, while the exportation of small ruminants, except for 1984 (Saudi Arabia livestock ban), has ranged more steadily between 1.1 and 1.5 million head per year.

Figure 1.1/1 Livestock Development and Use

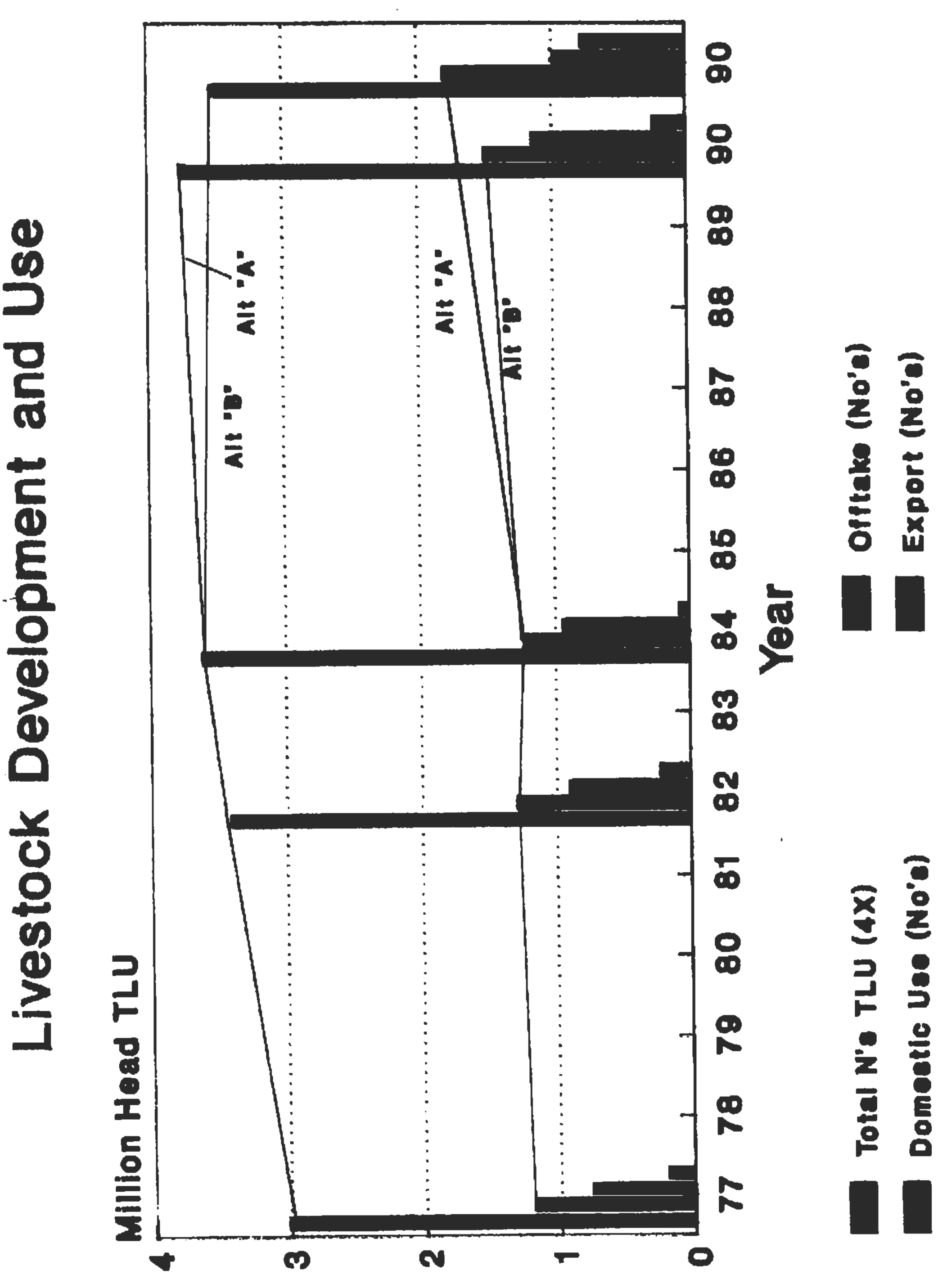
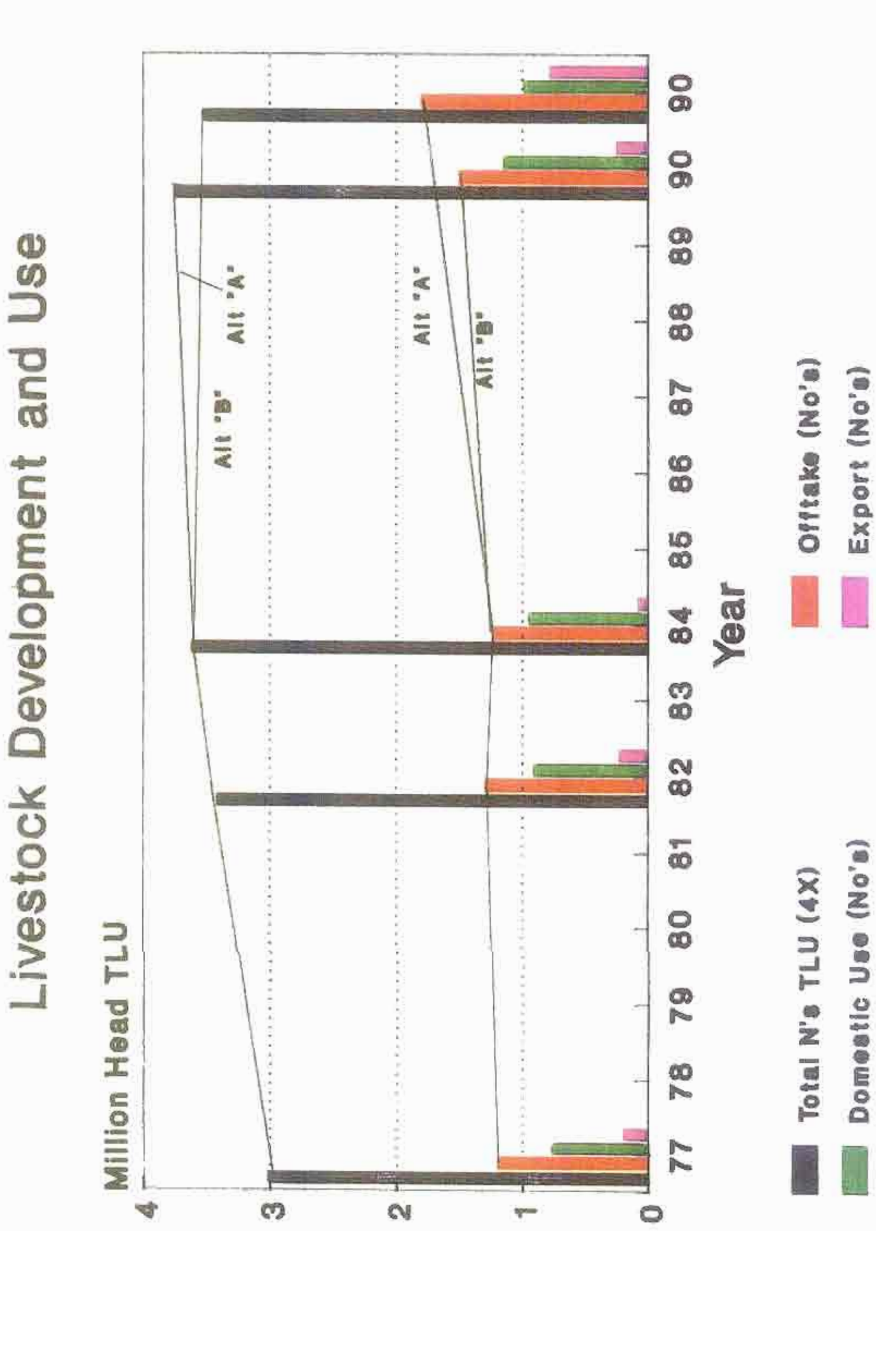


Figure 1.1/1 Livestock Development and Use



Domestic livestock consumption based on slaughter figures is presented in Table 1.1/2.

Table 1.1/2 Livestock Domestic Consumption ('000 Head)

Year	Cattle	Camels	Goats	Sheep
1970	238.9	49.5	2,963.5	1,607.8
1971	246.9	56.8	2,531.2	1,509.8
1972	286.9	64.8	2,994.6	1,656.1
1973	246.4	57.1	2,468.9	1,254.8
1974	217.6	44.3	1,137.9	1,161.3
1975	276.3	53.5	1,807.4	632.0
1976	259.8	52.4	2,236.9	1,497.5
1977	329.6	57.4	2,655.9	1,972.6
1978	302.1	93.0	2,464.2	1,830.4
1979	306.0	78.0	2,397.2	1,372.6
1980	322.8	97.7	2,004.3	1,459.9
1981	382.0	99.3	2,117.5	1,304.0
1982	347.7	93.6	2,349.4	1,583.8
1983	286.0	92.5	1,738.7	1,712.8
1984	302.3	103.8	1,865.6	1,781.0

Source: [29]

The table shows increasing consumption trends for beef and camel meat but stagnant or declining trends for small ruminant meat.

1.2 Livestock in the Juba Valley

Livestock estimates of 1984 for the three Regions Gedo, Middle Juba and Lower Juba are shown in Table 1.2/1.

Table 1.2/1 Livestock in the Juba Valley

Region	Area (km^2)	Camel (No.)	Cattle (No.)	Sheep (No.)	Goats (No.)	TLU (1)
Gedo	38,592	329,000	231,000	183,000	723,000	670,000
Middle Juba	43,572	219,000	383,000	102,000	356,000	615,000
Lower Juba	35,114	163,000	823,000	52,000	209,000	880,000
3 Regions	117,278	711,000	1,437,000	337,000	1,288,000	2,165,000

Source: [85]

1) 1 TLU = 250 kg; 1 camel = 1.2; 1 cattle = 0.8; 1 S.R. = 0.1 TLU.

As the Development Area includes also 5 Districts of Bay and Lower Shebelli Region, these estimates have to be increased by 25-30% which would lead to about

900,000 camels
1,800,000 cattle
420,000 sheep and
1,600,000 goats making use of Juba riverine resources.

The above findings seem to be consistent with data in 1987 for JESS collected for a much smaller area of the floodplains extended by a 30 km strip on either side of the river between Kismayo and the future dam site; estimating during the late dry season

350,000 camels
600,000 cattle
420,000 sheep and
700,000 goats.

Livestock densities in the Juba river floodplains during January 1987 have been studied and assessed by the JESS-Team:

Table 1.2/2 Livestock Densities in the Floodplain

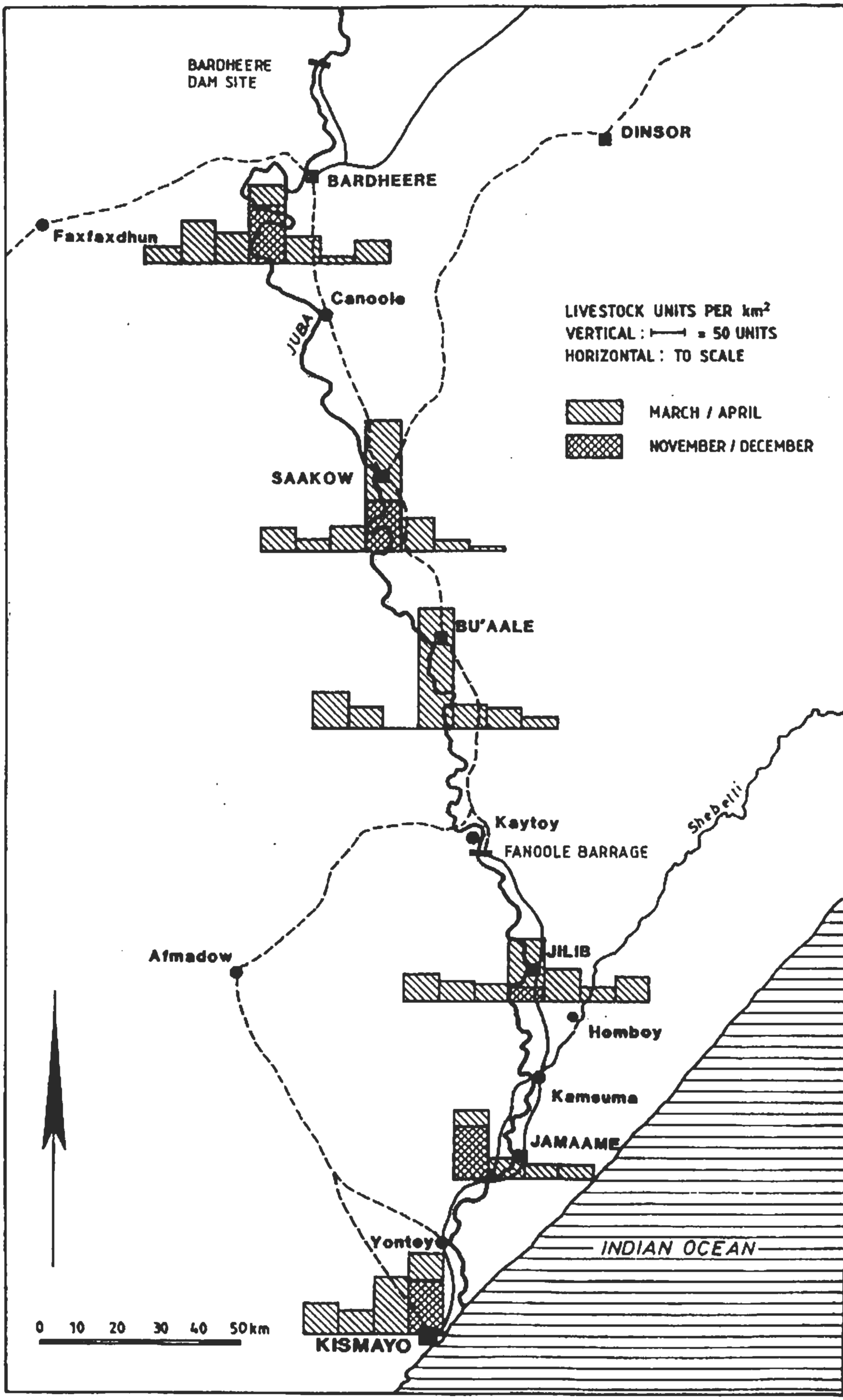
Location	Cattle	Sheep	Goats	Camels	TLU (1)
	Heads per km²				
Kismayo - Jamaame	82	14	27	1	71
Jamaame - Fanoole	22	5	15	0	42
Fanoole - Bu'aale	0	0	0	0	0
Bu'aale - Barow Dinle	70	7	18	9	69
Barow Dinle - Dam Site	69	19	63	8	71

1) 1 TLU = 250 kg; 1 camel = 1.2 TLU; 1 cattle = 0.8 TLU; 1 S.R. = 0.1 TLU.

Livestock densities as they were extracted from unpublished figures of the 1987 Livestock Survey carried out by JESS are presented in Figure 1.2/1.

The reasons for the seasonal increase in livestock densities in the floodplain are obvious. The river offers drinking water when most of the surface water catchments are exhausted, tsetse flies have "protected" part of the riverine grazing grounds during the rainy season and, crop residues from flooded or irrigated agriculture represent a valuable source of dry season feed for non-browsing animals.

Figure 1.2/1 Livestock Densities after the 1987 Livestock Survey carried out by JESS



1.3 Livestock Ownership

Typical herd composition and size of big and small nomadic livestock owners are presented in Table 1.3/1.

From these findings can be deduced that nomadic livestock ownership in the Juba valley shows different patterns:

- Big owner, camel-type : 150 camels and 235 small ruminants
- Big owner, cattle-type : 8 camels, 200 cattle and 125 S.R. (1)
- Big owner, mixed-type : 105 camels, 80 cattle and 130 S.R.

- Small owner, camel-type : 25 camels and 55 small ruminants
- Small owner, mixed-type : 7 camels, 35 cattle and 50 S.R.

Table 1.3/1 Nomadic Livestock Ownership

District	Big Owner			Small Owner		
	Camel	Cattle	S.R.	Camel	Cattle	S.R.
Bardheere	100	80	200	20	40	40-50
Bu'aale	100	100	100	0-5	10	20-25
Jilib	100-120	50-60	80-100	2-3	-	20-30
Afmadow	150	-	300	20-30	-	50
Jamaame	15	200	100-150	15	-	20
Kismayo A	2	200	100-150	-	40-60	80-100
B	150	-	150-200	20-30	-	50- 60

Source: Team field trip findings (March, April 1988).

Information about livestock owned by farmers and agro-pastoralists is rather incomplete. From scarcely available data based on different sources (JESS, field trip findings of AHT-Team etc.) can be derived that

- rainfed and irrigation farmers within the Study Area keep relatively small numbers of livestock, mainly cattle and small ruminants;

- the average cultivated area of mixed farmers would range between 10 ha (rainfed/north) and 2 - 3 ha (irrigated/deshek/south);

- animal traction is hardly practiced except for donkeys in the tsetse free north and oxen (and bulls) in the area south of Jilib for transport of various commodities;

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1) S.R. = small ruminants

- the average number of livestock per mixed farmer would be 5 - 10 cattle and 5 - 12 goats and sheep;
- agro-pastoralists with much higher livestock numbers exist in the Dinsor/Baydhabo area and near the Kenyan border in Afmadow and Saakow Districts (rainfed sorghum production).

The latest field trip findings (April 1988) are summarized in Table 1.3/2.

Table 1.3/2 Mixed Farmer Ownership

Location	Cultivated area ha	No. of Camels	No. of Cattle	No. of Small Ruminants
Bardheere	10	-	10-15	10
Bu'aale	5	-	5-10	10-20
Jilib	3-5	-	8-20	5
Jamaame (average)	2-3	-	2-3	5-6

Source: AHT team interviews (4/88).

1.4 Livestock Movements

At present, the large majority of Juba river related livestock belongs to pastoralists having their homes, 'degaans', out of the tsetse-infected river valley in the open bush or grassland east and west of the river.

Based on numerous interviews with experienced people and taking into account the main findings of a recently carried out study by the JESS Team there seem to be 3 main pastoral movement patterns (mainly for camel and cattle):

- a west-east movement from and to the river;
- a north-south movement between lower and higher rainfall and
- a movement between rainy season rangelands and dry season crop cultivation areas.

In addition to these feed resource-oriented transhumance motivations, there are other reasons for pastoralists to move with their stock, like seasonal watering and soil conditions, temporary threat of biting and sucking insects, tribal or family meetings etc.

Not all animals are participating in pastoral movements, especially small ruminants and some (old) lactating cows and their offspring commonly stay behind with part of the family. Traditional nomadic transhumance patterns can be totally disturbed or changed if a severe drought has struck the area. Under extreme drought conditions pastoralists usually gather lower rivers, settlements and main roads awaiting eventual humanitarian relief actions.

In Map 12 of the accompanying atlas the prevailing pastoral movements under normal rainfall conditions are tentatively delineated. Clearly visible are the three main dry season feed and water resources: on both river banks, specially between Bu'aale and Jilib, in Afmadow (1) and Deshek Waamo and in the rainfed sorghum cultivation area of Dinsor and Baydhabo.

During the rainy season generally good grazing and watering conditions exist outside the river valley, sometimes on very distant locations outside the national boundaries (i.e. Kenya, Ethiopia).

Sedentary livestock is usually not engaged in long distance transhumance but also uses grazing resources outside the actual farming areas, in the open rangelands.

1.5 Livestock Productivity

In the Development Area reliable data about animal husbandry practices are scarce and in some cases inconsistent. Relatively well-founded knowledge of certain production parameters vary substantially with differing herd sizes and pastoral practices.

The following description of the main livestock species is based on available information from zones with similar ecology and interviews with reliable professional individuals.

Camels are the most important species for pure pastoralists in the northern and western part of the Juba valley, although they are found within the whole Development Area. Camels are kept for milk and meat production and for transport of goods. Except for weak members of the family, camel-riding does not exist. Lactating camel cows show remarkable milk yields of at least twice as high as cattle cows (900 - 1200 kg per lactation), and camel milk is highly appreciated by Somali consumers. But only part of the females can be milked due to high first-breeding age, long pregnancy period and relatively low fertility rates.

Camels are extremely sensitive to trypanosomiasis and they fear certain sucking insects like Tabanidae. They can stay without drinking water for one week to three weeks, they can carry loads of several hundred kg over very long distances.

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1) 1988, due to the drought, livestock usually present during the dry season, had to move elsewhere, some animals were found in Jamaame District (April, 1988).

Camels do not depend on grazing resources alone, they can live on twigs and leaves of shrubs and trees to a large extent (= browsing).

The lower offtake rate is based on the above issues and on relatively high calf mortality whereby the epidemiology is not well known.

Reasonably founded information on camel production would include the following zootechnical parameters:

Fertility rate	25 - 35 %
Female breeding age	5 - 6 years
Mortality 0-1 yrs.	10 - 25 %
1-3 yrs.	5 - 10 %
adults	2 - 5 %
Offtake rate	1.5 - 2 %
Milk production	1000 - 1200 kg per lactation (50% to the calf).

Cattle are very popular with pastoralists of the total Juba valley showing distinct concentration in the southern part of the Development Area. Compared with camels, they possess a much higher overall productivity, allowing an offtake rate of close to 10% per year.

In the tsetse free areas north, west and east of Bardheere, the Surqa (or Jiddu) breed is predominating; in the southern part, Boran breed is most commonly used. Cattle (specially Surqa) are sensitive to animal trypanosomiasis, of which they can be treated and protected with trypanocidal drugs.

Concerning nutrition, cattle are not able to use browsing resources like camels and goats but they are able to favorably convert all sources of roughage (i.e. crop residues) into animal protein.

Their watering intervals should not exceed 2 - 3 days. Cattle facilitate nomadic sedentarization and some authors [115] believe that 70% of the total East African cattle population is kept by (partly) sedentary agro-pastoralists.

Although general use of cattle for animal traction is still very low, oxen and bulls are increasingly used by town and village population south of Jilib for transport of water, firewood and other goods.

Under normal rain conditions, cattle production parameters in the Development Area could be estimated as follows:

Fertility rate	45 - 55%
Female breeding age	3 - 4 years
Mortality 0-1 yrs.	15 - 20%
1-2 yrs.	around 10%
adults	2 - 3%
Offtake rate	10 - 11%
Milk production	400-500 kg per lactation (50% to the calf).

Small Ruminants (S.R.) can be dealt with in one group because of their common herding and similar productivity except for milk production and grazing/browsing habits. In the Development Area goats (ca. 80%) dominate distinctively over sheep (ca. 20%) because of two major reasons. Meat consumers in the Development Area (apparently due to health reasons) prefer relatively lean goat meat to fat sheep meat paying much higher (= 50-100%) prices for the former. Goats are producing more milk than the kids need. All sheep are belonging to the Berbera Blackhead breed having a strongly-developed fat-rump under good feeding conditions.

Two different goat breeds can be found in the Juba valley, the complete white Galla breed and the colored or long-haired Somali-Arabian Dairy Goat with considerably high milk yield (200-300 l/lactation). Zootechnical parameters could be estimated, as follows:

	Sheep	Goats
Fertility rate	70 -100%	70 -100%
Female breeding age	1.5 - 2 years	1.5 - 2 years
Mortality 0-1 yrs.	30 - 40%	30 - 40%
1-2 yrs.	15 - 20%	15 - 20%
adults	5 - 10%	5 - 10%
Offtake rate	22 - 24%	20 - 25%
Milk production	50 - 60 kg/lact. (100% for lamb)	90 - 100 kg/lact. (50% for kid)

Donkeys are mainly used in villages and towns specially in tsetse free areas because of their high sensitivity to animal trypanosomiasis, general spreading can be expected after total tsetse eradication.

Chicken kept in back yard or scavenger-type poultry production pattern are quite common in small settlements, villages and towns. They are not competing for human food as they usually live on household and grain harvesting leavings as well as on protein sources from insects, beetles and caterpillars.

Near bigger towns (i.e. Kismayo), specialized commercial poultry units exist which usually suffer from shortage of protein concentrate and other essential inputs.

1.6 Livestock Feeding

The majority of Juba valley livestock is continuously or seasonally living on natural grazing and browsing resources (see ANNEX 8 "Range and Forestry"). Apart from these fodder plants, an increasing number of non-browsing animals (mainly cattle and sheep) is making use of available by-products from crop cultivation. In the following Table 1.6/1, available statistical data on food and cash crop production within the Development Area have been converted into palatable livestock fodder (DM base).

An interesting result of the conversion is the availability of almost 550,000 tonnes of dry season feed, mainly for non-browsing species like cattle and sheep. An estimated number of 1.8 million cattle and 0.4 million sheep are probably making use of these resources during the advanced dry season period. It can be assumed that cattle and sheep of the Juba valley meet at least 50% of their dry season feed requirements from available crop residues within the Development Area.

Table 1.6/1 Dry Matter Feed from Crop Residues (in '000 t)

Region	Maize Grain	Maize Stover (1)	Sorghum Grain	Sorghum Stover	Rice Grain	Rice Straw	Beans Pulse	Beans Straw	Sesame Seed	Sesame By-Products (2)
Lower Juba	19.3	57.9	-	-	2.7	8.1	0.6	1.8	2.8	8.4
Middle Juba	24.9	74.7	7.5	22.5	5.2	15.6	1.2	3.6	2.9	8.7
Gedo	11.7	35.1	12.0	36.0	-	-	0.7	2.1	2.6	7.8
Bay (3 Districts)	N.A.	-	(50%) 76.3	228.9	-	-	(50%) 2.7	8.1	-	-
Bakool L. Shebelli (small part)	N.A.	-	(10%) 5.0	15.0	-	-	(10%) 0.8	2.4	2.0	6.0
Total		167.7		302.4		23.7		18.0		30.9
Total Development Area:						542,700 tons				

Source: [42]

1) DM Stover would be 3 times as much as grain.
2) By-Products are: stalks, leaves, chaff (from threshing).

Agro-industrial by-products are partly utilized. Rice bran from the rice mills in Fanoole and Mogambo are used by semi-intensive dairy and poultry production units.

Sugar by-products are not available for livestock feeding: Cane leaves and tops are almost totally destroyed by the burning process (before combine harvesting), bagasse is entirely burnt in the steam turbine and generator plant of the factory, and molasses is sold to the world market at low prices because of the factory's need for foreign currency.

Rice straw is partially burnt on the fields (Fanoole) or bailed and sold on the Kismayo fodder market at relatively high prices (5-20 SoSh/kg DM).

Unfortunately, there is very little palatable by-product from banana production, as most of the crop residues are not eaten by existing livestock.

Summing up, it may be said that rainfed and irrigated food crops have very valuable crop residues while, under prevailing management conditions, irrigated export-oriented crops (sugar cane, banana) make no or little contribution to livestock feeding in the Study Area.

1.7 Livestock Watering

The main source for livestock watering during the (Jilaal) dry season is the Juba River. Water access is sometimes restrained or disturbed by irrigation farms along the river banks leaving no space for livestock passage. The second largest watering facility for Juba valley livestock are at smaller or bigger desheks, where thousands of animals can drink at one time.

Favourable topographical conditions and sufficient rainfall have motivated people to collect surface runoff water and to excavate artificial water reservoirs ("wars"). Some 25 big Government-built (mostly EEC-funded) wars of 20-50,000 m^3 are concentrated in the eastern part of the river in Bay, Middle Juba and Lower Shebelli Region (see Map 17 of the atlas).

Besides, there are thousands of small wars of a few hundred to 2,000 m^3 built and owned by private livestock producers, in the same area, and on the western part of the Development Area, between Afmadow, Diif and Badhaade. According to rainfall, surface water reservoirs usually serve during the rainy season and part of the dry season only. In most of the cases war-watered livestock has to proceed to river or deshek water during the crucial second half of the Jilaal.

Ground water is another important source for human and livestock water supply. In the northern plateau zone, in numerous river beds (tugs) shallow wells are commonly dug into sand or gravel underground. Water is drawn by hand, as the water table is usually not very deep. Further south, favourable conditions for hand-dug shallow wells prevail in the Juba and Shebelli River alluvial zone between Bu'aale and the river mouth and on the final part of Shebelli River (swamps and creeks).

A number of generator and pump-equipped bore-holes with mostly large watering capacities have been installed during the last 25 years by the Government in collaboration with donor organizations. These tubewells are concentrated in three regions of the Development Area (see Map 13):

- Gedo (Garbaharey, Luuq, Ceel Guduud)
- Bay (south of Baydhabo), and
- Lower Juba (Afmadow district: Liboy, Afmadow, Canjeel, Hasingo)

Many livestock watering facilities based on tubewells are not functional because of insufficient water yield, high salinity, technical breakdowns or insufficient operation budget. Well functioning boreholes are easily recognizable because of typical overgrazing pattern around the watering facility.

General water quality and especially salinity problems of available drinking water are addressed in ANNEX 2.

1.8 Livestock Export Marketing

At present, livestock export marketing from the Development Area is seriously affected by a number of constraints.

Export marketing from Kismayo Port has developed unfavorably during the last 8 years as Table 1.8/1 shows.

Table 1.8/1 Kismayo Exports 1980 - 1987

Year	Camel	Cattle	Sheep	Goats
1980	5,944	29,374	5,151	4,371
1981	6,384	31,889	1,665	2,538
1982	5,262	51,011	4,500	4,516
1983 (1)	3,225	7,326	3,292	3,294
1985	1,650	22,265	-	-
1986	250	9,715	-	-
1987	2,095	4,168	1,050	1,050

Source: [110]

1) Year of Saudi Arabian import ban on African livestock.

Detailed export figures for Kismayo are given in Table 1.8/2.

Table 1.8/2 Kismayo Export 1987/88

	Camels	Cattle	Small Ruminants	Destination
1987				
January	-	700	-	Yemen Arab Rep.
January	400	-	-	Egypt
February	-	1,200	-	Y.A.R.
March	-	-	-	-
April	-	-	-	-
May	-	800	2,100	Y.A.R.
May	-	1,468	-	Egypt
May	450	-	-	Saudi Arabia
June	-	-	-	-
July	600	-	-	Egypt
August	645	-	-	Egypt
September	-	-	-	-
October	-	-	-	-
November	-	-	-	-
December	-	-	-	-
Total 1987	2,095	4,168	2,100	-
1988				
January	774	-	-	Egypt
January	-	1,550	-	Egypt
February	-	-	-	-
March	-	1,550	-	Egypt
Subtotal 1988	774	3,100	-	-

Source: [110]

According to the above statistics, only camel exports show a positive trend since the 1983/84 market breakdown. The exportation of Juba valley cattle and small ruminants is still considerably disturbed.

Unfavourable livestock export marketing in southern Somalia is connected with the overall national marketing situation. The main problems and constraints hindering the sector include:

- lack of proper marketing intelligence on all levels
- weak communication linkages
- insufficient health control of export animals

- many individual traders having little capital assets on their own
- livestock trade generating little profits to traders
- excessive taxation on trade stock
- difficulties to fulfill Letter of Credit conditions in time
- use of unsuitable ships for livestock export
- difficulties in reaching international standards (OIE/FAO)
- unfavourable exchange rates for part of the export proceedings.

Due to deteriorating export market opportunities from Kismayo, livestock owners have found an unofficial/illegal outlet to Kenya to where according to credible estimations some 50,000 head of cattle have been exported in 1987. By this exercise, foreign currency earnings of the Government are reduced, and the risk of propagation of epizootic diseases to Kenya and East Africa is increased. The Tsetse control project in the southwest (GTZ-supported) has a domestic marketing component aiming to study and improve livestock offtake and marketing on nomadic production level.

According to reliable information from international marketing specialists (1), overall market opportunities for Somali export livestock are not bad and growing, if domestic supply conditions can be improved.

A recently established body called Livestock Marketing and Health Project (Figure 1.8/1) supported by USAID is supposed to improve the present weak system by physical, organizational and monetary support and improvement measures (i.e. building of appropriate quarantine stations). Unfortunately, the expected positive impact does not yet reflect on Kismayo export figures.

In the framework of this project, a physical improvement programme on Kismayo Port, Laheley Quarantine Station and Jilib Holding Ground level was agreed on.

Specially Laheley Quarantine Station, which is in poor shape, would need immediate improvement and support. At present, the station is suffering from poor infrastructure, lack of equipment and supplies and from insufficient funding.

The external fencing is insufficient and previously good pasture grounds have been heavily overgrazed during the last two years.

The following quarantine operation plan would certainly improve the situation if it would become functional.

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1) i.e. M. Cessam from Livestock Marketing and Health Project, Final Report, Nov. 1987.

Figure 1.8/1

Organizational Structure

of

Livestock Marketing and Health Project

Field Department

Operation Sites

Export Ports

Quarantine Station	Major Ports	Holding Grounds
Laheley Kismayo	Berbera	Arori-Rurao
Warmaban Afgoi	Mogadishu	Mulq-Mulq-Gelib
Lafarug Berbera	Kismayo	Qoolare-Hargeisa

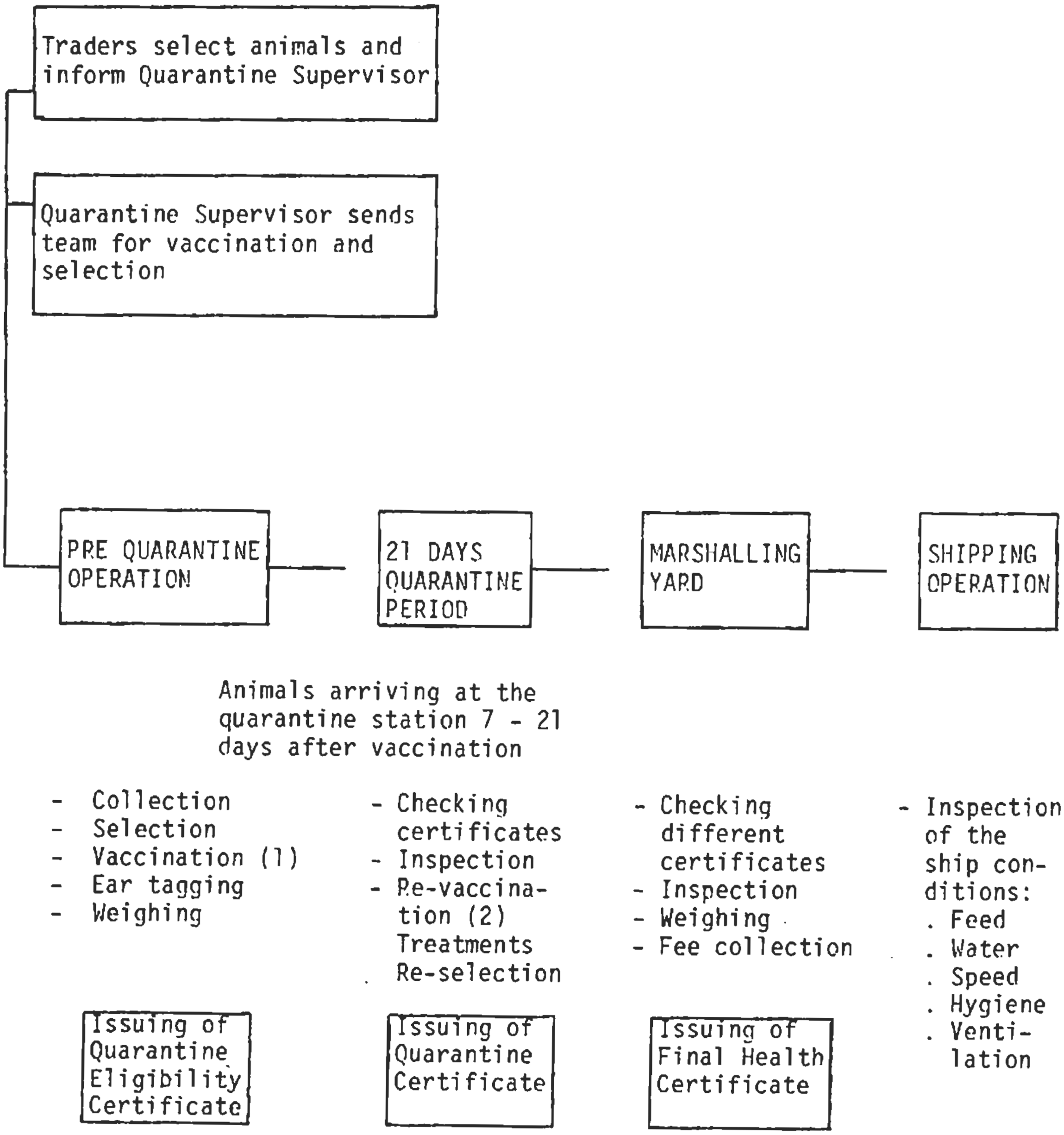
Smaller Ports

Sanag Reg.	Bari Reg.	Nugal Reg.	Mudug Reg.
Hiis	Bosaso	A. Eyl	Hobyo
Maydh	Gandala		
Las Qorey	Bargal		
Elayo	Alula		
	Bender Biela		
	Hurdiya		

Figure 1.8/2

Quarantine Operation Plan

(according to Livestock Marketing and Health Project)



1) Against Anthrax, H.S., CBPP, B.Q.
2) If necessary repeat (1),plus Rinderpest, Foot and Mouth Disease.

1.9 Income Derived from Livestock Production

In accordance with chapters "Livestock Ownership" and "Livestock Productivity" a tentative calculation of pastoralists' revenue is presented in Table 1.9/1.

Table 1.9/1 Tentative Calculation of Nomadic Income

Item	Big nomadic owner camel type	Big nomadic owner cattle type	Big nomadic owner mixed type	Small nomadic owner camel type	Small nomadic owner mixed type
No. of camels	150	8	105	25	7
Offtake rate (%)	2	2	2	2	2
No. of sold camels	3.0	0.2	2.1	0.5	0.1
No. of cattle	-	200	80	-	35
Offtake rate (%)	N.A.	10	10	N.A.	10
No. of sold cattle	-	20	8	-	3.5
No. of s.r.	235	125	130	55	50
Offtake rate (%)	23	23	23	23	23
No. of sold s.r.	54	28.8	29.9	12.7	11.5
Unit price:					
- camel (SoSh)	25,000	25,000	25,000	25,000	25,000
- cattle (SoSh)	12,000	12,000	12,000	12,000	12,000
- s.r. (SoSh)	2,500	2,500	2,500	2,500	2,500
Meat value:					
- camel (SoSh)	75,000	4,000	52,500	12,500	3,500
- cattle (SoSh)	-	240,000	96,000	-	42,000
- s.r. (SoSh)	135,000	72,000	74,750	31,700	28,750
Milk for sale (1)					
- camel (1, 2)	18,563	990	12,994	3,094	886
- cattle (1, 3)	-	14,850	5,940	-	2,599
Milk value:					
- camel (SoSh)	928,125	49,500	649,688	154,688	43,313
- cattle (SoSh)	-	594,000	237,600	-	103,950
Production value (SoSh)	1,138,125	959,500	1,110,538	198,888	221,513
Home consumption (20%) (in SoSh)	227,625	191,900	222,108	39,778	44,303
Marketable surplus (in SoSh)	910,500	767,600	888,430	159,110	177,210

s.r. = small ruminants

1) Camel milk: SoSh 50/l; cow milk: SoSh 40/l.
2) About 75% female camels, of which 30% are lactating, are producing about 550 l of milk for human consumption (or sale) per year.
3) About 66% female cows, of which 50% are lactating, are producing about 225 l of milk for human consumption (or sale) per year.

Table 1.9/1 indicates that

- camels are mainly kept for their milk production
- camels generate very little income from offtake
- cattle herd are less productive in milk as camels but recover much better from offtake rate compared to camels
- small ruminants play an essential role in nomadic income due to their high offtake rate.

The livestock-related income of mixed farmers, according to integration pattern described under 1.3 would compile as follows:

- 7 (5-10) cattle would generate 0.7 animals per year at 12,000 SoSh = 8,500 SoSh.
- 8 (5-12) small ruminants would generate 2 animals per year at 2,500 = 5,000 SoSh.
- 2 lactating cows would produce (2 x 225) 450 l of milk per year at 50 SoSh = 22,500 SoSh.
- 2 lactating goats would produce (2 x 50) 100 l of milk per year at 50 SoSh = 5,000 SoSh.

The total livestock production value of mixed farmers would therefore amount to (8,500 + 5,000 + 22,500 + 5,000) 41,000 SoSh per year of which a minor part would go for home consumption.

1.10 Animal Health in the Development Area

The Ministry of Livestock, Forestry and Range is largely represented in the Development Area. The animal health-related network controlled by the Department of Animal Health comprises 3 Regional Veterinary Coordinators (RVC) in Kismayo, Bu'aale and Garbaharey and 17 District Veterinary Officers (DVO) in the Kismayo, Baadhaade, Afmadow Jamaame, Bu'aale, Jilib, Saakow, Dinsor, Bardheere, Elwak, Gorbahare, Bulo Hawa, Luuq, as well as parts of Brava (Lower Shebelli) Kansa Dhere (Bay) Baydhabo and Wajid (Bakool R.).

Generally, due to extremely low budgets and lack of equipment and supplies the system is weak and exhausted.

Most of the offices, clinics, stores and accommodations are in need of repair and rehabilitation.

Drugs are mostly available in the District Office but cannot be properly applied and/or distributed to production level because of lack of transport equipment and the necessary consumables (spare parts, fuel etc.). Due to prevailing employment conditions, abundantly available relatively well-trained staff is hardly prepared, equipped and motivated to carry out the necessary clinical and field work, including public health-oriented control measures (i.e. meat inspection).

Besides the basic ministerial (administrative) infrastructure, a few additional animal health facilities have to be mentioned.

- The supra-regional Veterinary Laboratory at Kismayo is well equipped and staffed to carry out parasitological, microbiological and serological diagnose on livestock of southern Somalia belonging to nomads, urban and village dwellers, export traders etc. The laboratory is still receiving support in equipment and supplies from an ongoing donor follow-up programme (GT7). Because of the weak veterinary care system available capacities are not well used.

- In Yaaq Braawe and Redille (near Bu'aale) an EEC-funded project has installed veterinary facilities consisting of a spray race, crush, dip, weigh bridge, shady concrete place, office and storage buildings etc. The Redille Station has been rehabilitated recently.

- The quarantine station of Laheley has a partly fenced surface of 200 km^2 = 20,000 ha. The infrastructure comprises 2 equipped boreholes, 2 cattle crushes, one dipping tank, offices, stores and labour-quarters (poor condition) and a double-fenced isolation corral. The station is suffering from poor transport facilities and supply, and due to overstocking by trade cattle during the last years, most of normally good pasture is now totally grazed down and/or overgrazed. Laheley Quarantine Station is part of the recently established Livestock Marketing and Health Project under the MLFR.

- Recently (1987) an animal health-oriented Tsetse Control Project (GTZ-funded) in the so-called "Kenya Salient" (south and west of Kismayo) has been established. Besides the entomological component, the work programme also includes tick control and control of tick-borne diseases. The Project has an office building and attached facilities in Kismayo and a Field Station near Bulo Haji (Badhaade District).

The animal disease situation in the Development Area is not quite clear, as exact data are not sufficiently available. Based on reports of RVCs and DVOs and on informal interviews with professional staff, the following feature may be expected. Because of high mobility and frequent contacts with other animals, changing soil and watering conditions, nomadic livestock is exposed to various animal diseases.

Some of the epizootical (contagious) diseases like Rinderpest are now under control although the vaccination coverage might not be strong enough for sustained protection from outside contagion. But, Somalia belongs to the OAU-sponsored Panafrican Rinderpest Campaign (PARC) and in all border areas (including the Development Area) national cattle stock will be repeatedly vaccinated against Rinderpest and Contagious Bovine Pleuropneumonia (CBPP). Other contagious diseases of small ruminants like sheep pox and Contagious Caprine Pleuropneumonia (CCPP) seem to exist in the area requiring also regular vaccination over a certain period. A wide range of parasites threatens Juba valley stock.

Gastrointestinal endoparasites affect, in particular, young and underfed animals whereby spreading is facilitated in big herds and at permanent water points (i.e. flooded depressions: desheks, ponds etc.). Ectoparasites (i.e. ticks) weaken the organism and serve as vectors for the transmission of certain diseases.

1.11 Summary of Limiting Factors

1.11.1 Limiting Factors for Animal Health

- Insufficient linkage and communication between livestock owners (particularly nomads) and Veterinary Services,
- unfavourable road conditions hindering efficient interventions in case of disease outbreak,
- shortage of essential veterinary drugs on production level,
- unreliable and low vaccination coverage,
- weak, under-equipped veterinary service specially on district level,
- widespread incidence of blood parasites transmitted by ticks and tsetse flies,
- high incidence of gastrointestinal infestation facilitated by unhygienic watering conditions,
- high mortality of young camels (causes not well known),
- high cattle mortality during the transition period of dry and wet seasons (malnutrition, soil-borne diseases),
- prevailing epidemiology and pathology not well known,
- insufficient veterinary public health control.

1.11.2 Limiting Factors for Animal Productivity

- Seasonal shortage of feed mainly for cattle and sheep,
- seasonal difficulties in livestock watering (river/desheks),
- unscrupulous use of natural pasture,
- high pressure on limited resources specially in the South of the Study Area,
- increasing cultivation of export-oriented crops having little or no crop residues for livestock feeding,
- lack of (imported) inputs on specialized dairy and poultry units,
- insufficient integration of crop and livestock production,
- insufficient knowledge of appropriate food/forage cropping pattern,
- lack of production-oriented extension,

- lack of mixed farming pilot and demonstration units,
- insufficiently developed forage production for live animal export requirements,
- unused potential for livestock finishing/fattening,
- nutritive potential of crop residues not fully used,
- available agro-industrial by-products insufficiently utilized in animal production (i.e. molasses),
- potential for rational beekeeping not fully used,
- back yard poultry production not fully used.

1.11.3 Limiting Factors for Livestock Marketing

1.11.3.1 National Constraints

- Unfavourable exchange rates for export earnings,
- lack of reliable postal telecommunications,
- unfavourable macroeconomic conditions,
- heavy taxation on trade and export stock.

1.11.3.2 Regional Constraints (1)

- Deteriorating cattle marketing opportunities in the Red Sea and Gulf Countries,
- weak marketing infrastructure at Kismayo Port,
- incomplete quarantine facilities at Laheley,
- lack of marketing knowledge,
- shortage of feed/forage for export animals,
- uncontrolled cattle exportation to Kenya.

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1) Development Area.

2. General Development Concept

2.1 National Development Planning

In order to insert the sub-sectoral development of the Development Area into National Livestock Development Planning, the main objectives, policies and targets of the 5-Year Development Plan (1987-92) [47] have to be considered:

> "No further numerical expansion should be sought....
> The present task is to consolidate appropriate pastoral production systems and aims at achieving stable, long-term outputs, giving due considerations to conservation issues. Since large numbers of people are productively engaged in nomadic pastoralism even small improvements above traditional standards will result in significant contributions to economic growth.
>
> Future progress in crop production, especially in areas under irrigation, can lead to the introduction of semi-intensive and intensive animal production models. These developments are likely to take place in the inter-riverine (1) area where a mixed farming approach is technically feasible.
>
> To increase livestock production within the limits set by conservation measures in order to meet home consumption demand..... and secure a supply of commodities for export; to promote domestic trade in livestock and livestock products, to engage in applied research analyzing essential components of the pastoral economy; to increase competitiveness of livestock for exports.
> Collection, analysis and appropriate storage of data .... of the livestock sector ....."
>
> "Organization of trade-oriented groups of producers....
> Monitoring and evaluation of performance .... improve baseline information ..... formulate proposals aimed at optimizing the number of nomadic people who could live off the range in each region.
>
> Stable export outlets will be secured through competitive marketing adhering to international trading standards. Mixed farming in southern regions will explore plans for greater integration between crop and cattle production.
>
> .. Formulation of regional masterplans.
> Training programmes will be emphasized....
> Private sector activities, if effective and dynamic, will be encouraged....
>
> Animal health services and measures ... will be intensified thus reducing livestock losses.
> Better husbandry, improvement in feeding and reduction in losses due to better animal health schemes will result in large offtake increases".

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1) It can be assumed that the authors meant "riverine".

General conclusions:

"a) The growth potential of livestock output from nomadic pastoralism is limited.

b) No further increase in livestock numbers will be sought.

c) Contribution to further growth is expected to come from increase in productivity through better husbandry practices, improvement in management and reduction in losses and waste.

d) Livestock output is expected to meet local requirements for milk and meat consumption.

e) Contributions to foreign currency earnings through livestock export will remain substantial in terms of total export revenues.

f) The livestock and range sector is expected to have a growth rate of approximately 3 per cent per year."

2.2 Development Planning in Juba Valley

In accordance with the above national objectives and targets and in line with prevailing limiting factors the general development concept must focus on the following goals and purposes:

- livestock production and quality increased,
- income of rural population and livestock owners increased,
- livestock and crop productivity increased,
- animal health improved,
- range resources of the Development Area increased,
- crop productivity on farm level and dry season animal nutrition increased,
- revenues from livestock export increased,
- herd offtake rates increased,
- bee honey and bee wax production increased.

A number of national improvement measures would be required to create favourable macroeconomic conditions for the livestock development in the Juba valley:

- liberalization of veterinary drugs,
- privatization of veterinarians and zootechnicans,
- improvement of veterinary drug supply,
- favourable exchange rates for export earnings,
- continuous exploration of potential markets for Somali livestock.

Some of these measures are formulated, planned or under negotiation, some others have to be addressed in the near future.

3. Specific Development Concept

Based on the general development concept and taking realistic development opportunities into account, the development of Juba valley livestock should focus on three main fields:

a) animal health
b) animal production
c) livestock marketing.

3.1 Improvement of Animal Health Care (Services)

Development efforts should concentrate on veterinary infrastructure, animal health organization, assured drug supply down to the livestock owners and addressing specific pathological constraints of the area.

Concerning veterinary infrastructure, the 17 District Veterinary Offices (DVO) of the Development Area have to be supplied with appropriate 4WD vehicles, refrigerators, veterinary instruments and basic laboratory equipment. Houses, offices, clinics and store rooms must be rehabilitated and maintained, and basic operation costs must be covered by their budget.

Based on encouraging results from the Central Rangeland Development Project (CRDP), primary animal health care should be introduced to improve the overall animal health service organization.

Nomadic Animal Health Auxiliaries (NAHAs) would be connected to nomadic families or Range Livestock Associations (RLAs). They are operating as private, independent "barefoot" veterinarians who are prepared to cover great distances without external aid, following the pastoral migration movements of their relatives.

NAHAs would close the gap between Government Veterinary Services and nomadic livestock owners, to the advantage of both: better drug supply to livestock owners and better feedback of health information (surveillance) to the Veterinary Services.

The NAHA organization would ensure a continuous supply of essential veterinary drugs down to grass roots level. Besides, the presently weak drug supply system needs a permanent solution at the Ministry of Livestock, Forestry and Range (MLFR) supply level, where donor supported improvement measures are underway or in the pipeline.

The problem of animal trypanosomiasis causing serious losses has been identified and addressed in the Masterplan for Tsetse Eradication by the National Tsetse and Trypanosomiasis Control Project (NTTCP). According to NTTCP, there is a realistic chance that the riverine Glossina species of both river systems (Shebelli and Juba) will be eradicated within the next ten years - before the year 2000. In the meantime, livestock making use of riverine resources (even seasonally) will depend on the application of appropriate trypanocidal drugs.

The non-riverine tsetse belt in the so-called 'Kenya Salient' (south and west of Kismayo) is separated from the riverine tsetse infested areas by a Glossina-free corridor which passes between Deshek Waamo in the north and Bulo Haji in the south. Within the Kenya Salient a FRG-funded Tsetse Control Project is underway, and part of the area is designated for the establishment of a Wildlife Reserve.

Whenever feasible domestic animals should be protected by appropriate vaccination measures. Rinderpest and Contagious Bovine Pleuropneumonia (CBPP) will be controlled by the Pan African Rinderpest Project (OAU/PARC), a fully negotiated EEC-Project is ready for implementation. Other contagious, partly soil-borne diseases of Juba valley livestock require regular vaccination to be carried out by the strengthened veterinary service.

For rationally planning and implementing of veterinary measures which are based on reliable health and production parameters, a comprehensive baseline survey is required. Investigations should be carried out on nomadic and sedentary herd level in form of a system approach leading to monitoring and evaluation of applied therapeuthic and prophylactic interventions.

Based on the results of the Animal Disease Survey a veterinary intervention calendar for zones with similar ecosystems should be developed where the annual timing of the main preventive measures is explained and laid down.

Most of these measures need basic and advanced training of the target personnel.

3.2 Increase in Livestock (Animal) Productivity

An appropriate development concept aiming at sectoral improvement of animal performance and productivity should include programmes, projects and measures on nomadic pastoral, a mixed farming, urban producer and of large-scale production level.

Support for pastoralists would concentrate on range conservation and management activities, supply of livestock watering facilities and sustained supply of consumable inputs like drugs and chemicals.

Building up of nomadic self-help groups similar to village committees should be promoted in the framework of commonly used grazing grounds and watering facilities. So-called "Range and Livestock Associations" (RLAs) around home Degaans have been successfully introduced in the Central Rangelands Development Project (CRDP). This organization into production and trade-oriented groups would facilitate ecologically beneficial range conservation and range management measures.

Some places of the Development Area seem to be promising for further development of water resources. However, new high-yielding groundwater pumping stations should only be installed if overgrazing can be prevented and avoided through controlled grazing in the nearer surroundings of the watering facility. Furthermore, nomadic and sedentary livestock should have a guaranteed access to riverine water in between intensively cultivated farmland along the river or deshek banks because most of the Juba valley livestock needs this water resource during the second half of the dry season (Jilaal).

The introduction and promotion of crop/livestock integration seems to be particularly justified in the Juba valley development, before and after the construction of the Bardheere dam. Because of numerous mutual advantages leading to increased animal and crop production the process of integration should be encouraged, demonstrated and stimulated wherever feasible.

Livestock kept under a mixed farming management would use valuable natural pasture in the surroundings of the farm during the rainy season, and crop residues and farm by-product during the dry season period. Scavenger-type poultry would live on household residues which are unfit for ruminants and on animal protein sources from insects, beetles, caterpillars and the like.

On the other hand, domestic animals offer a variety of advantages to the farmer:

- animal traction will economically alleviate heavy farm work and improve the transportation of inputs and products,

- animal manure will maintain and/or improve soil fertility when chemical fertilizers are not available or uneconomic to apply,

- milk producing livestock and egg producing poultry will improve the nutrition of the family and/or generate regular income throughout the year,

- surplus herd animals (offtake) can be sold when contingencies or necessary family expenses arise.

The gross margin from livestock production in a mixed farming system can reach up to 50% of the total gross margin of a farm under rainfed conditions (see Tables 1, 2, 3, Appendices 3 and 4, ANNEX 4).

Under certain conditions valuable cultivation land could be seasonally or permanently used for forage crop production. Leguminous forage could then feed livestock and increase soil fertility through appropriate crop rotation pattern.

Many issues of mixed farming systems are not well known or have not been tested and experienced in Somalia and in the Juba valley. Livestock-related topics have to be integrated into planned or existing agricultural research stations.

One of the basic conditions for a successfully operating mixed farming programme would be a well established and functional integrated extension service and the existence of a few pilot and/or demonstration units within the Study Area.

The extension service should provide crop, animal husbandry and health-oriented advice.

The urban and peri-urban poultry and dairy units depend on specific inputs which mostly have to be imported at present: premix, coccidiostats, vaccines for oral application, intra-mammary tubes, mineral salts, vitamins etc.

Especially in the lower part of the river, export-oriented livestock production on a large scale could be envisaged. Such an intensive unit would rely on mechanized forage crop production, available agro-industrial by-products (i.e. molasses, oil cakes) and a few imported inputs. The units would require favourable macroeconomic and institutional conditions as well as sustained recovery of cattle export marketing.

Besides a few large-scale export-related feed lots practicing mechanized forage production within an economic range of Kismayo Port, an additional finishing or fattening structure for export animals could be envisaged based on smallholder or family farm forage production units. The produced, conserved or processed fodder can be used for purchased (lean) animals or sold to livestock traders for the feeding of export animals.

The intensively producing finishing/fattening structure in the vicinity of Kismayo would attract relatively young stock from the more distant rangelands, and by this, increase herd offtake on reproduction/production level in the Juba valley hinterland to the advantage of the overall carrying capacity.

As described and developed in Chapter 1.6 (Livestock Feeding) a considerable amount of agricultural crop residues of probably more than 500 thousand tons per year is presently available for livestock feeding. Proceeding on the assumption that these resources will increase along with growing crop production over the planning period, the specific development concept should formulate und propose possibilities and limitations for the most rational use of these products.

The nutritive value of crop residues can be considerably improved by physical (e.g. chopping) and/or chemical (e.g. ammonia) processing.

Digestibility can be increased by supplementing with other feedstuffs (i.e. molasses or urea) and the like.

At present, crop residues do have a high market value especially in the lower part of the Development Area. However, experiences from other parts of the world have shown that there is no long-term advantage in carrying low-value, bulky forage over long distances. If some non-farming livestock owners have an interest in paying high prices for agricultural by-products, the benefits drawn from these products should also prevail on the farm.

For the production of 1 kg of milk or meat under zero-grazing management, at least 5 to 10 times more forage is required. Therefore, the long-term development concept should aim at carrying finished products like milk to the consumer market while keeping performing livestock as near as possible to the source of forage.

For the time being, export animals will create and maintain a demand for livestock fodder at and near to Kismayo. But most probably, the situation will change when exported animals will be slaughtered in the country and refrigerated carcasses or cuts will be exported, like in most of the African countries (e.g. Kenya).

In that case, forage requirements for export animals presently kept in quarantine stations, marshalling yards or ships will drop to zero.

Due to prevailing range conditions, nomadic livestock is more and more suffering from shortage of dry season feed (pasture). While camels and goats browse trees and shrubs, cattle and sheep depend on residues from agricultural production.

In the North, "as a consequence of close ethnic relationships with the agro-pastoralist population of the Bay Region" (Janzen, 1988), during the dry season, nomadic stock usually consumes available residues from rainfed sorghum crops of Dinsor and Baydhabo area.

In the South, sedentary and nomadic stock is living on riverine crop residues during the late dry season.

Increasingly recognizing the nutritive potential of crop residues, some of the nomads are already engaged in food crop production because of the following advantages:

- maize and sorghum crops grow extremely well on previously heavily manured areas around the nomadic camps or villages;

- grain from food crop cultivation helps to balance excessive protein consumption (milk and meat);

- crop residues from own food crop production represent an excellent source of dry season feed for non-browsing livestock (cattle and sheep).

For these reasons, it can be generally expected that Somali nomadic pastoralists, especially those keeping a majority of cattle in their herd, will follow the example of other East African nomads who are increasingly integrating livestock and crop production and thus becoming agro-pastoralists (1).

Others are prepared to pay relatively high prices for forage like rice straw, maize or sorghum stover etc. in order to overcome seasonal shortage of livestock feed.

Export-oriented crop production in the Juba valley (banana, sugar cane, cotton) generates few or no palatable by-products under prevailing management practices.

Banana residues are of low value for ruminants; cotton stalks are hardly palatable; cotton seed and cotton seed cake are not available for livestock.

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1) K. Meyn, [115] pointed out "that 70% of the toal East African cattle herd is kept by sedentary agro-pastoralists".

Sugar by-products are partly lost (cane tops, leaves) during harvesting, bagasse is burnt in the steam engines, and molasses is exported although the foreign exchange earnings are very low.

Combined with largely available roughage from grazing, browsing and crop residues, molasses, cotton seed and small quantities of urea would be an ideal ration for more productive (possibly genetically improved) dual-purpose cattle.

The woody flora of Juba valley offers excellent potential for rational beekeeping. Existing practices should be developed aiming at an improved bee honey and bee wax production. Carried out by small farmers of the Development Area, beekeeping could generate a regular income to the meagre farm budget.

3.3 Improvement of Livestock Marketing

In spite of the establishment of the Livestock Marketing and Health Project cattle exports from Kismayo port show a continuous decline since 1985:

- 1985 22,265 cattle
- 1986 9,715 cattle
- 1987 4,168 cattle

These official export figures do not include unofficial cattle exports to Kenya which at present are estimated at about 50,000 heads per year. It can be assumed that Kenya's livestock imports of Somali cattle will increase in the future.

The main problems still hampering Somali livestock exports are:

- unfavourable exchange rates for part of the export proceedings,
- lack of reliable, rapid postal telecommunications with potential markets,
- heavy taxation on trade and export stock,
- restriction on shipping and insurance,
- inproper sanitary and quarantine conditions,
- difficulties in fulfilling international standards (OIE/FAO).

With reference to the Development Area where probably more than 6 million heads of livestock live, of which about 2 million are cattle, the following improvements and policies should be introduced:

- The USAID-supported Livestock Marketing and Health Project should immediately carry out the agreed physical improvement programme in Lahele and Kismayo.

- The Government should apply appropriate policies to create favourable macroeconomic conditions for live animal export. Taxes and fees have to be revised and hampering monopolies abolished.

- The unofficial export of Juba valley cattle to Kenya must be reoriented to existing marketing outlets at Kismayo or overland export market facilities have to be created near the Kenyan border.

- Through intensive international marketing exploration, additional (live) cattle marketing opportunities must be identified and proper arrangements concluded, (e.g. similar to the contract with Egypt in 1986).

- Better marketing knowledge would have an impact on the nomadic production system leading to higher herd offtake and sales of younger stock to the markets. By this exercise, overgrazed and overstocked rangelands would recover and improve.

- Fodder production for export market stock would increase along with the expected progress of crop production and a mixed farming within the Development Area.

4. Development of Livestock Production Output in the Study Area

The suggested improvements in animal health care, additionally available crop residues and the proposed introduction of fodder production in mixed farming systems, which are characterized by an increased integration of crop and livestock production, will lead to an increase of livestock productivity and production.

Productivity increases are reflected in higher birth rates as a combined effect of reduced mortality and improved fertility, allowing for higher offtake rates and increased meat production for export and domestic consumption purposes. Improved dry season feeding will result in higher live and carcass weight and in higher milk productivity.

Table 4/1 summarizes the major production and productivity parameters for camels, cattle and small ruminants expected to materialize until 2005 in the Study Area.

Table 4/1 Development of Major Livestock Production and Production Parameters in the Study Area

Item	Unit	Year 1988	1995	2000	2005	Total increase (%)
Camel:						
Herd	No.	900,000	909,000	919,000	927,000	3
Offtake rate	%	2.00	2.25	2.50	2.75	38
Meat production	t/year	4,500	5,113	5,744	6,373	42
Export	No.	2,500	3,000	4,000	5,000	100
Domestic Consump.	No.	15,500	17,453	18,975	20,493	32
Calving rate	%	30	35	37.5	40	33
Milk prod./head	kg	1,100	1,200	1,200	1,200	9
Milk production for sale (1)	t/year	111,375	143,168	155,081	166,860	50
Cattle:						
Herd	No.	1,800,000	1,827,000	1,854,000	1,882,000	5
Offtake rate	%	10.5	11.0	11.5	12.0	14
Carcass weight	kg	125	128	130	133	6
Meat production	t/year	23,625	25,724	27,717	29,924	27
Export	No.	60,000	70,000	80,000	90,000	50
Domestic Consump.	No.	129,000	131,000	133,000	136,000	5
Calving rate	%	50	55	57.5	60	20
Milk prod./head	kg	450	500	550	600	33
Milk production for sale (1)	t/year	135,000	167,475	195,443	225,840	67
Small ruminants:						
Sheep and goats	No.	2,000,000	2,115,000	2,254,000	2,369,000	18
Goats	No.	1,600,000	1,715,400	1,802,900	1,895,000	18
Offtake rate	%	22	24	25	26	18
Carcass weight	kg	12.50	12.75	13.00	13.25	6
Meat production	t/year	5,500	6,472	7,326	8,161	48
Export	No.	2,000	5,000	10,000	15,000	650
Domestic Consump.	No.	438,000	502,700	553,500	601,000	37
Kidding rate	%	85	90	95	100	18
Milk prod./doe	kg	100	105	110	115	15
Milk production for sale (1)	t/year	15,111	17,011	18,730	20,582	36

Source: Tables 1-3, APPENDIX 1

1) Excluding calf/kid requirements.

5. Income Development for Nomadic Livestock Owners

Applying the improvement in livestock productivity expected for the year 2005 to the income calculation of typical nomadic livestock owners an increase in their income by about 50% could be achieved for both small and big herd owners (see Table 5/1).

The potential increases in livestock income achieved by sedentary farmers keeping livestock are described in Section 11.4 of ANNEX 4.

Table 5/1 Tentative Calculation of Nomadic Income (2005)

Item	Big Nomadic Owner Camel Type	Big Nomadic Owner Cattle Type	Big Nomadic Owner Mixed Type	Small Nomadic Owner Camel Type	Small Nomadic Owner Mixed Type
No. of camels	155	8	108	26	7
Offtake rate (%)	2.75	2.75	2.75	2.75	2.75
No. of sold camels	4.2	0.2	3.0	0.7	0.2
No. of cattle	-	210	84	-	37
Offtake rate (%)	N.A.	12	12	N.A.	12
No. of sold cattle	-	25.2	10.1	-	4.4
No. of small ruminants	277	148	153	65	59
Offtake rate (%)	26	26	26	26	26
No. of sold s.r. (*)	72.1	38.4	39.9	16.9	15.3
Unit price:					
- camel (SoSh)	25,000	25,000	25,000	25,000	25,000
- cattle (SoSh)	12,000	12,000	12,000	12,000	12,000
- s.r. (SoSh)	2,500	2,500	2,500	2,500	2,500
Meat value:					
- camel (SoSh)	106,219	5,665	74,353	17,703	4,813
- cattle (SoSh)	-	302,400	120,960	-	52,920
- s.r. (SoSh)	180,245	95,875	99,710	42,185	38,350
Milk for sale: (1)					
- camel (1) (2)	27,810	1,483	19,467	4,635	1,260
- cattle (1) (3)	-	25,200	10,080	-	4,410
Milk value:					
- camel (SoSh)	1,390,500	74,160	973,350	231,750	63,000
- cattle (SoSh)	-	1,008,000	403,200	-	176,400
Production value (SoSh)	1,676,964	1,486,100	1,671,573	291,638	335,483
Home consumption (20%) in SoSh	335,393	297,220	334,315	58,328	67,097
Marketable surplus (SoSh)	1,341,571	1,188,880	1,337,259	233,311	268,386

(*) s.r. = small ruminants
1) Camel milk: SoSh 50/l; cow milk: SoSh 40/l
2) About 75% female camel, of which 40% are lactating, producing about 600 l of milk for human consumption (or sale) per year.
3) About 66% female cows, of which 60% are lactating producing about 300 l of milk for human consumption (or sale) per year.

ANNEX 7 / APPENDIX

Livestock Production and Productivity Parameters

Table 1: Development of Camel Production and Productivity

Item	Unit	1988	1995	2000	2005	Total Increase (in %)
Camels (1)	No.	900,000	909,000	919,000	927,000	3
Offtake rate	%	2.00	2.25	2.50	2.75	38
Offtake	No.	18,000	20,453	22,975	25,493	42
Carcass weight/animal	kg	250	250	250	250	-
Total meat production	t/year	4,500	5,113	5,744	6,373	42
Export	No.	2,500	3,000	4,000	5,000	100
Domestic consumption	No.	15,500	17,453	18,975	20,493	32
Reproductive female (75%)	No.	675,000	681,750	689,250	695,250	3
Calving rate	%	30	35	37.5	40	33
Lactating female	No.	202,500	238,613	258,469	278,100	37
Annual milk product./head	kg	1,100	1,200	1,200	1,200	9
Milk for sale	kg	550	600	600	600	9
Total milk production for sale	t	111,375	143,168	155,081	166,860	50

(1) Low growth rate due to increased offtake and productivity (calving rate).

Table 2: Development of Cattle Production and Productivity

Item	Unit	1988	1995	2000	2005	Total Increase (in %)
		Year				
Cattle (1)	No.	1,800,000	1,827,000	1,854,000	1,882,000	5
Offtake rate	%	10.5	11.0	11.5	12.0	14
Offtake	No.	189,000	200,970	213,210	225,840	19
Carcass weight/animal	kg	125	128	130	133	6
Total meat production	t/year	23,625	25,724	27,717	29,924	27
Export - shipped	No.	10,000	15,000	20,000	25,000	150
- over land (Kenya)	No.	50,000	55,000	60,000	65,000	30
Domestic consumption	No.	129,000	131,000	133,000	136,000	5
Reproductive female (2/3)	No.	1,200,000	1,218,000	1,236,000	1,254,667	5
Calving rate	%.	50	55	57.5	60	20
Lactating female	No.	600,000	669,900	710,700	752,800	25
Annual milk product./head	kg	450	500	550	600	33
Milk for sale	kg	225	250	275	300	33
Total milk production for sale	t	135,000	167,475	195,443	225,840	67

(1) Assumed low growth rate of less than 0.5 % per annum due to increased offtake rate. Reduced mortality and improved fertility through better animal health care. Improved dry season feeding with increasingly available crop residues will result in higher live and carcass weight and in higher milk production per head.

Table 3: Development of Small Ruminants Production and Productivity

Item	Unit	1988	1995	2000	2005	Total Increase (in %)
Small ruminants	No.	2,000,000	2,115,000	2,254,000	2,369,000	18
-of which goats	No.	1,600,000	1,715,400	1,802,900	1,895,000	18
Offtake rate	%	22	24	25	26	18
Offtake	No.	440,000	507,600	563,500	615,940	40
Carcass weight/animal	kg	12.50	12.75	13.00	13.25	6
Total meat production	t/year	5,500	6,472	7,326	8,161	48
Export	No.	2,000	5,000	10,000	15,000	650
Domestic consumption	No.	438,000	502,700	553,500	601,000	37
Reproductive female goats (2/3)	No.	1,066,667	1,143,600	1,201,933	1,263,333	18
Kidding rate	%	85	90	95	100	18
Born kids (1)	No.	906,667	972,060	1,021,643	1,073,833	18
Lactating does (2)	No.	604,444	648,040	681,096	715,889	18
Individual milk yield	kg/doe	100	105	110	115	15
Milk for sale (3)	kg	25	26.25	27.5	28.75	15
Total milk production for sale	t	15,111	17,011	18,730	20,582	36

(1) About 1.5 kids per goat (50 % twin births).
(2) Number of lactating does is about 1/3 less than the number of born kids.
(3) 50 % twin mothers have no milk for sale, 50 % single kid mothers produce about 50 kg/doe for sale. Average milk yield for sale: 25 kg/doe.

ANNEX 8

S O M A L I A

Masterplan for Juba Valley Development

Forestry and Range

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List of Abbreviations

FAO	-	Food and Agriculture Organization
JESS	-	Juba Environmental & Socio-Economic Studies
LSU	-	Land System Units
NRA	-	National Range Agency
NTTCP/LUS	-	National Tsetse and Trypanosomoasis Control Programme
RMR/SRS	-	Resource Management & Research/Southern Rangeland Survey
SES	-	Somali Ecological Society
SRP	-	Somali Research Project
WWF	-	World Wildlife Fund

Range and Forestry

1. The Present Stage of Development

1.1 Land Use Surveys in Southern Somalia

Comprehensive large-scale surveys of land use in Southern Somalia have been carried out in the recent past by FAO/Lockwood (1967) [107], Huntings Technical Services (1977) [23], Resource Management & Research (1983/84) [85] and by the National Tsetse and Trypanosomiasis Control Project - Land Use in Tsetse Affected Areas of Southern Somalia (1988/84) [40].

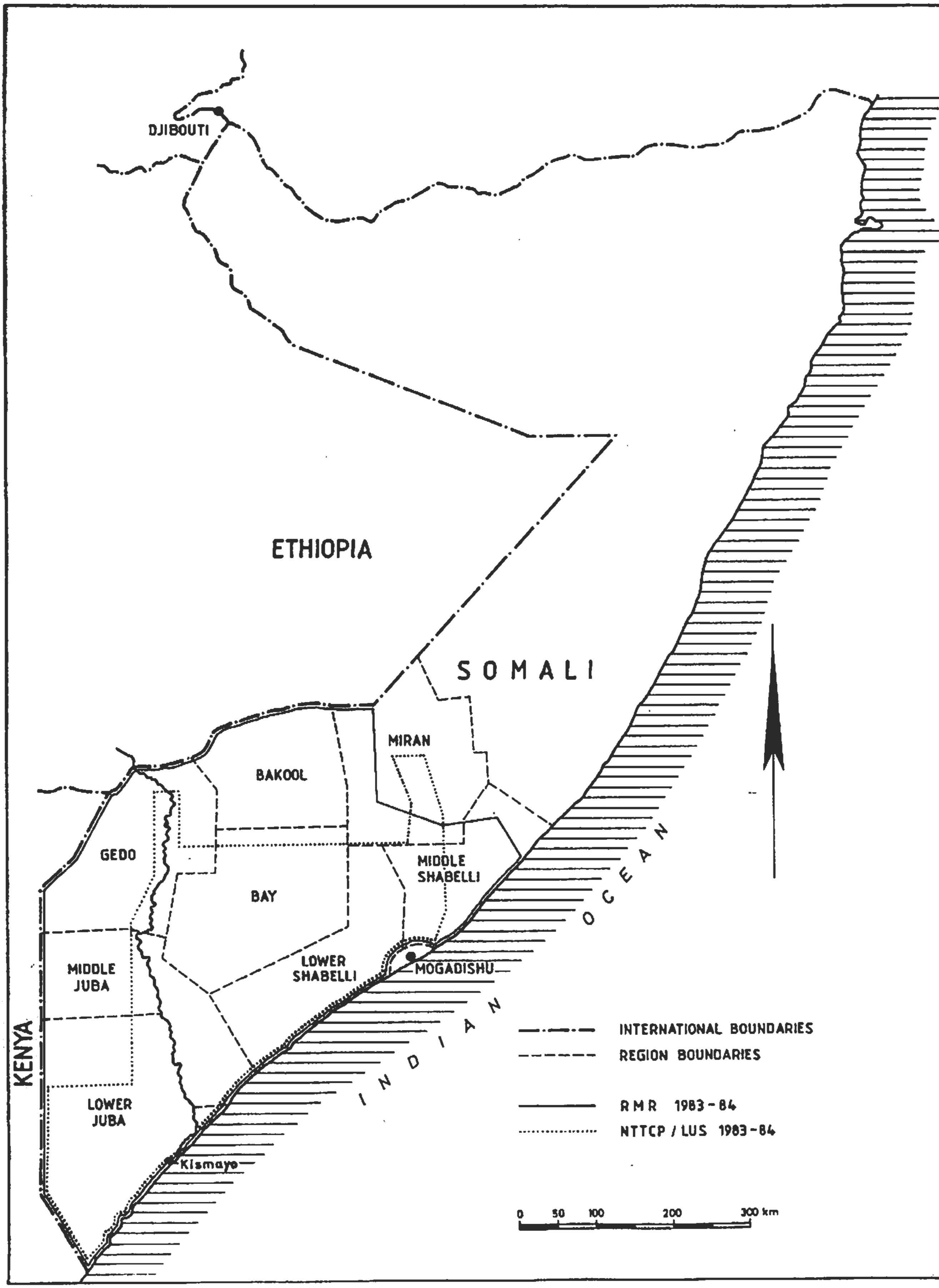
The surveys of FAO/Lockwood and HTS were based on the interpretation of aerial photography, taken at 1:60,000 scale in 1960. The RMR survey was based on analysis of Landsat satellite imagery and on low-level aerial sample surveying. The FAO study also included some low-level aerial census work, though at a low sampling intensity and relatively low accuracy. All studies have included ground survey work. The FAO/Lockwood surveys included detailed surveys of farming systems and crop yields, range land vegetation and productivity, and water resources, as well as geology and soil surveys. The RMR survey included detailed assessments of range vegetation resources and observations on other aspects of land use. The NTTCP/LUS surveys have included air photo interpretation of 1983/84 photography as well as qualitative surveys of the farming systems, livestock production systems and stock movement patterns (concentrated in areas affected by tsetse), and records of livestock herd and flock performance.

All these major studies of land resources and land use have delineated Land Regions or Land System Units (RMR) as relatively homogeneous blocks of land within which to describe land resources. The boundaries of these regions or units have been determined in each case on the basis of geology, land form, soils, vegetation types and land use. The different studies have, however, operated at different scales and levels of detail and have not therefore used the same framework of land regions or units. Thus, the FAO/Lockwood study delineated 14 Regions within the 208,500 km^2 of their study area. RMR delineated 177 Land System Units (LSUs) within 228,044 km^2, while the LUS studies have distinguished 23 Land Regions (LR) in 150,000 km^2. The boundaries of these LRs and groups of LSUs broadly coincide at major geomorphological boundaries but there are many differences in detail which complicate the comparison of results from the different surveys.

The major difficulties of comparison of estimates of land use made by different authorities are in the definitions of the classifications of land use and the delineation of the areas/regions/land units to which they apply. The three major studies of land use (FAO/Lockwood 1967, RMR 1983/84 and NTTCP/LUS 1983/84) have each used different definitions of vegetation, physiognomic and agricultural land use types and have distinguished different regions or zones as the framework for presentation of results. It is important that future land use assessments are made with the most objective and clearly stated definitions of vegetation and land use types and that data are presented in the most dispersed form to allow compilation into suitable land regions or zones for comparison over time and between different authorities.

Figure 1/1 shows the areas covered by the RMR and NTTCP/LUS surveys in southern Somalia.

Figure 1/1 Areas covered by RMR and NTTCP/LUS Surveys



1.2 Extent of Rangeland

Overall, rangelands cover 55 - 90% of Southern Somalia. In the Study Area, the percentage of rangeland in each district ranges from 70 to 98% as shown in Table 1.2/1.

Table 1.2/1 Extent of Rangeland Compared with other Land Uses for each District in the Study Area (km^2)*

Land Use	Bard-heere	Din-sor	Saa-kow	Bu'a-ale	Afma-dow	Ji-lib	Jamaa-me	Kis-mayo	Total
Cultivated land	893	605	669	149	129	463	551	132	3,591
Forest	1	-	1	16	-	1	1	-	20
Range land	4,033	2,391	4,937	5,246	5,548	4,458	1,614	3,518	31,745
Other	3	4	3	49	3	128	134	30	354
Total	4,930	3,000	5,610	5,460	5,680	5,050	2,300	3,680	35,710
% Range land	82	80	88	96	98	82	70	96	89

* Are considered here as rangeland: bush land, open bush land, bushed grassland, bushed dune land, grassland and thicket.

1.3 Vegetation in Southern Somalia

The NTTCP/LUS report [40] gives a good insight of vegetation in Southern Somalia. Hence, the major part of what follows is extracted from that report.

Very little natural vegetation survives in the large proportions of the Study Area which have been cultivated, grazed and burned over for centuries. The natural vegetation which does survive and the secondary vegetation types which have become established reflect the different combinations of climate, soils, and land use which occur.

The forests of both the Juba and the Shebelli River have similar flora. Typically the forest is a dense, tall, gallery type with evergreen trees up to 30 meters in height. Tree species include *Parkia filicoidea*, *Mimusops degan*, *Newtonia erlangeri*, *Ficus spp.*, *Afzelia quanzensis*, *Diospyros cornii*, *Trichilia jubensis*, *Tamarindus indica*, *Teclea alexandrae*, *Garcinia ferrandii* and *Hypseloderma jubensis* (this species known only from Somalia).

The characteristic vegetation of much of Southern Somalia and especially of the interriverine plains is that of a low deciduous bushland and shrubland mixture remarkable for its monotonous uniformity and with only slight variation from place to place in the association of a relatively small number of dominant species. The bush land and shrub land may remain drought dormant through much of the year. Typical species of the deciduous bush land and shrub land include Acacia bussei, A. seyal, A. reficiens, A. nilotica, A. nubica, A. mellifera, A. tortilis, A. senegal, Dobera glabra, Gardenia fiorii, Cordia sinensis, Grewis tenay, G. villosa, Combretum spp., Commiphora spp., Euphorbia spp., Thespesia danis and Dichrostachys spp., Boscia spp., Cadaba glandulosa and Maerua spp. are notable as minor evergreen components of the otherwise deciduous bush land/shrub land. Terminalia orbicularis is very frequent on heavier soils and Phyllanthus somalensis characteristically fringes seasonal water pans and water courses. When the bush land is opened up by fire, productive perennial grasslands can be formed and typical grasses include Chrysopogon plumulosus, Sporobolus helvolus, Cenchrus ciliaris, Andropogon kelleri and Eragrostis spp..

The low deciduous bush land and shrub land extend on to to coastal dunes where they are frequently dominated by Acacia tortilis and A. senegal. Other common dune bush land species are Cordia somalensis, Terminalia spinosa and, south of Baraawe, Adansonia digitata. Most of the deciduous bush land plants also occur on the dunes and are supplemented by numerous additional species to produce a rich and diverse flora. On the seaward side of the dunes, the vegetation assumes a prostrate physiognomy under the influence of strong prevailing winds. The beaches themselves carry a specialized flora which includes Ipomoea pescaprae, Scaevola plumieri, Atriplex farinosa and Sporobolus spicatus. Of particular interest is the sedge Cyperus chordorrhizus which dominates large areas immediately above the beach and provides important grazing. Open areas within the dune bush land support excellent grass cover and Cenchrus ciliaris grows vigorously.

In Trans-Juba, southwest of the Caanoole drainage, conditions of higher rainfall support bush lands with numerous evergreen species which become dominant towards the Kenyan border. The evergreen bush lands are very similar to the Boni vegetation of the Kenya coast hinterland. The extensive tsetse habitat of the Kenya coast is effectively extended into Somalia by the evergreen bush lands. Typical woody plants of the evergreen bush lands include Diospyros cornii, Manilkara spp., Carissa edulis, Uvaria spp., Premna resinosa, Polysphaera multiflora, Euclea spp., Heinsia spp., Strychnos spp., Tamerix spp., Tarenna graveolens, Gnidia latifolia and Croton spp. The evergreen bush lands include well grassed open areas with Hyparrhenia sp., Panicum sp., Digitaria spp., Chloris sp., Brachiaria sp., Echinochloa sp. and Tetrapogon sp. Trees and bushes are draped with Usnea (lichen) this being indicative of the relatively moist conditions.

Extensive tracts of saline soils within Southern Somalia support a specialized halophytic flora. Halophytes include Sueada spp., Salsola sp. and Limonium sp.. Urochondra setulosa and Sporobolus spicatus are frequent halophytic grasses, U. setulosa dominating extensive grasslands.

A series of freshwater swamps have developed in the extensive, poorly drained areas of both the Shebelli and Juba Valleys. Some of the swamps appear to be undergoing cyclic change. Whilst some are drying up, others are, in effect, becoming lakes. Thus, certain of the Shebelli swamps are obviously drying up, while the Waamo Deshek and the Hara Naga are flooded killing trees.

Open-water areas are usually clear of vegetation and the shallower margins support semi-floating aquatic plants such as Nymphaea spp., Nymphoides sp. and Pistia stratiotes. Further into the shallows large communities of Typha latifolia and Phragmites karka occur.

1.4 The Vegetation in the Study Area

The most common species that can be found in the Study Area have been compiled from the RMR survey [85] and are presented in Tables 1.5/1 and 1.5/2 along with Figure 1/2 showing the location of the different sites where botanical identification has been carried out.

1.5 The Five-Year Development Plans

1.5.1 Forestry

Under the Five-Year Development Plan 1982 - 1986, published by the Ministry of National Planning, the long-term objectives for forestry were:

- to control desertification and thus to protect the basic resource of the country

- to evaluate the various forest types as sources of fuel and building materials for the benefit of the people

- to expand the forest cover where appropriate as a means of increasing the supply of forest products

- to increase the production of minor forest products for the benefit of both the individual and the country as a whole.

More specific short-term objectives were:

- to strengthen the forestry department of the NRA in terms of numbers and technical training of staff

- to complete the inventory and mapping of the forest resources and to prepare management plans combining production and conservation

- to amend the forest law and carry out a non-formal education programme which will lead to greater participation by the local population in forestry production and protection activities

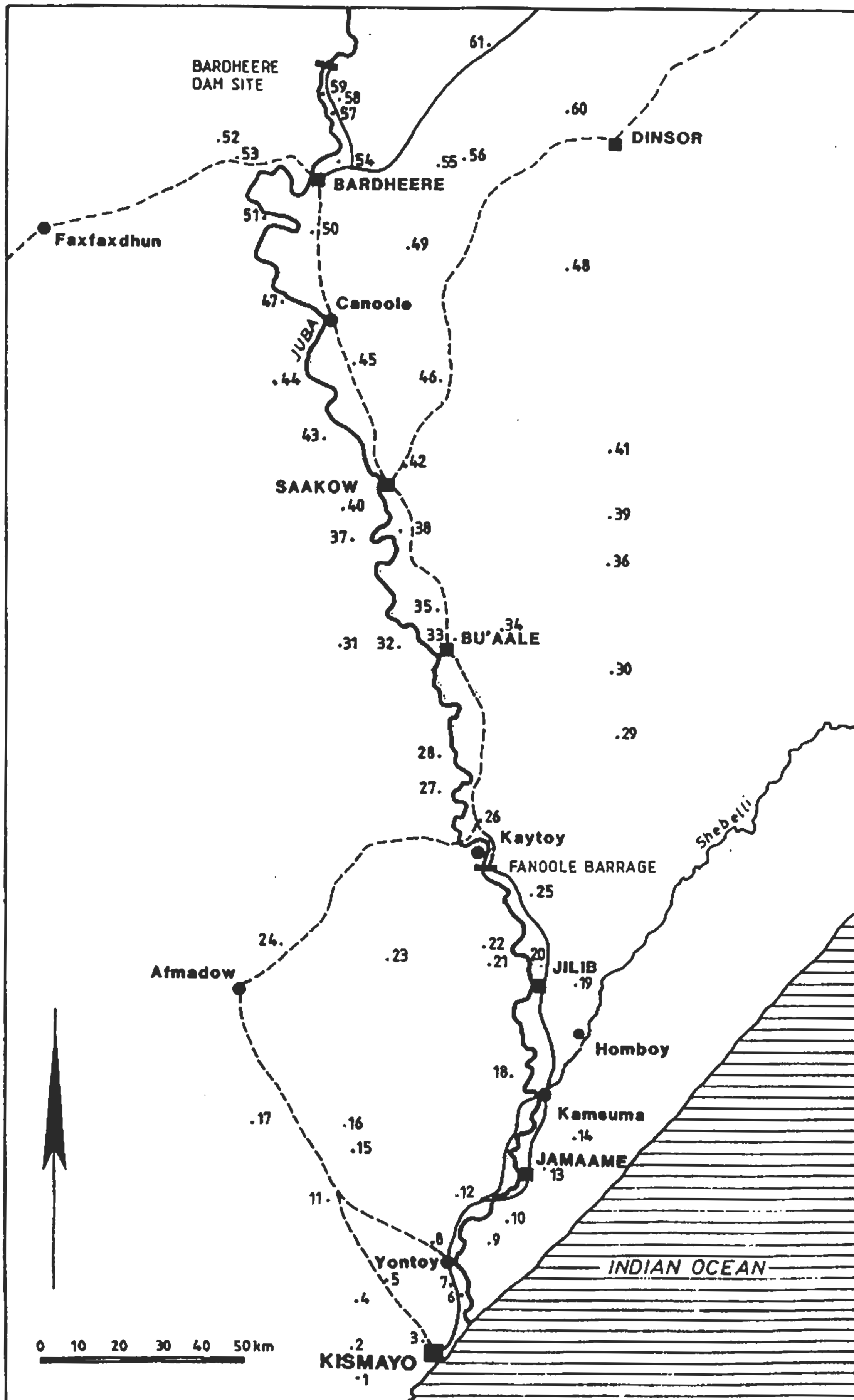
Table 1.5/1 Most Common Species in the Study Area According to the RMR/SRS Botanical Survey - Southern Area -

Map Location No.	RMR Site No.	Species
1	538/539	Combretum sp.; Grewia sp.
2	606/607	Gardenia fiorii; Blepharis persica; Terminalia spinoza; Commiphora sp.
3	494/495	Acacia nilotica; Gardenia fiorii; Grewia tenax; Blepharis tenax
4	655/656	n.a.
5	496/497	Terminalia sp.; Balanites sp.; Gardenia fiorii; Acacia zanzibarica
6	608/609	Acacia tortilis; Acacia senegal; Boscia coriacea; Commiphora sp.; Grewia sp.
7	610/611	Acacia zanzibarica; Combretum sp.; Asparagus sp.; Thespesia danis; Acanthaceae
8	612/613	Combretum sp.; Thespesia danis; Acacia zanzibarica; Acanthaceae
9	614/615	Combretum sp.; Cordia sp.
10	618/619	Dichrostachys cinerea; Malaceare, Indigofera sp.
11	498/499	Acacia zanzibarica; Combretum sp.
13	620/621	Acacia tortilis; Terminalia spinosa; Cordia sp.; Grewia sp.; Grewia tenax
14	622/623	Boscia sp.; Dichrostachys cinerea; Combretum greenwayii; Grewia tenax
15	674/675	n.a.
16	500/501	Dobera glabra; Acacia reficiens; Commiphora sp.
17	502/503	Dobera glabra; Dichrostachys cinerea; Combretum greenwayii; Grewia tenax
18	514/515	Acacia zanzibarica; Thespesia danis; Acacia drepanolobium
19	492/493	Acacia reficiens; Acacia mellifera; Combretum sp.
20	487	Dichrostachys cinera; Lippia danensis; Insigofera sp.; Clitorea ternatea
21	512/513	Thespesia danis; Caesalpinia
22	403/404	Acacia zanzibarica; Cadaba sp.; Grewia tenax; Grewia villosa
23	485/486	Acacia zanzibarica; Combretum greenwayii; Salvadora persica; Indigofera sp.
24	483/484	Terminalia parvula; Acacia reficiens; Combretum greenwayii; Anisotes trisulcus
25	490/491	Combretum greenwayii; Dichrostachys cinerea
26	488/489	Sarcostemma sp.; Thespesis danis; Dichrostachys cinerea; Combretum greenwayii
27	405/406	Albizia anthelmintica; Acacia reficiens; Combretum greenwayii

Table 1.5/2 Most Common Species in the Study Area According to the RMR/SRS Botanical Survey - Northern Area -

Map Location No.	RMR Site No.	Species
28	407/408	Combretum greenwayii; Dichrostachys cinerea; Grewia tenax; Grewia villosa
29	516/517	Combretum greenwayii; Caealpina trottae; Anisotes trisulcus; Indigofera sp.
30	518/519	Combretum greenwayii; Malvacea; Indigogera sp.
31	413/414	Acacia bussei; Acacia reficiens; Combretum greenwayii; Grewia tenax
32	411/412	Acacia bussei; Acacia seyal; Combretum greenwayii; Cordia sinensis
33	375/376	Acacia bussei; Acacia Reficiens; Anisotes trisulcus; Acanthaceae
34	373/374	Dichtrostachys sp.; Indigofera sp.; Cordia sp.; Combretum sp.; Grewia tenax
35	377/378	Acacia bussei; Acacia reficiens
36	520/521	Terminalia parvula; Caesalpinia trottae; Indigofera sp.
37	514/416	Acacia bussei; Acacia seyal; Acacia reficiens; Cordia sinensis
38	379/380	Cordia sp.; Grewia sp.; Boscia sp.; Ocinum sp.
39	371/372	Terminalia sp.; Dobera glabra; Combretum sp.; Acacia reficiens; Indigofera sp.
40	417/418	Terminalia sp.; Commiphora sp.; Dalbergia commiphoroides; Cordia sinensis
41	522/523	Acacia zanzibarica; Caesalpina trottae; Indigofera sp.
42	381/382	Acacia bussei; Dalbergia sp.; Croton sp.
43	419/420	Dalbergia commiphoroides; Terminalia orbicularis; Gardenia fiorii
44	421/422	Acacia bussei; Acacia reficiens; Commiphora sp.; Acacia mellifera
45	385/386	Dobera glabra; Acacia reficiens; Caesalpinia trottae
46	383/384	Dalbergia sp.; Terminalia sp.; Acacia reficiens; Commiphora sp.
47	423/424	Acacia reficiens; Acacia zanzibarica; Spirostachys venenifera
48	646/648	n.a.
49	764/765	n.a.
50	387/388	Acacia seyal; Commiphora sp.; Grewia tenax
51	425/426	Caesalpinia erianthera; Acacia reficiens
52	453/454	Acacia reficiens; Combretum sp.
53	455/456	Acacia reficiens; Commiphora sp.; Cadaba glandulosa
54	389/390	Dichrostachys sp.; Acacia nubica; Indigofera sp.
55	397/398	Acacia bussei; Acacia reficiens; Dalbergia sp.
56	399/400	Acacia bussei; Dalbergia sp.; Commiphora sp.; Gardenia fiorii
57	393/394	Acacia nilotica; Acacia seyal; Malvaceae
58	391/392	Acacia reficiens; Commiphora sp.; Euphorbia cuneata
59	395/396	Acacia senegal; Commiphora sp.; Euphorbia cuneata
60	401/402	Acacia seyal; Acacia horrida
61	191/192	Acacia reficiens; Acacia senegal; Dichrostachys cinerea; Boswellia sp.

Figure 1/2 Distribution of most common Species according to RMR/SRS Botanical Survey



- to expand the programme of sand dune fixation and national desertification control and improve the methodology and techniques of sand dune fixation

- to initiate a comprehensive programme of tree planting trials so as to provide the technical knowledge required for any eventual large-scale afforestation, the development of village wood lots, and the greater integration of forestry and agricultural activities

- to improve the technical and economic efficiency of charcoal production

- to improve in-country forestry training at all levels.

In its review of performance for the 1982 - 1986 plan period, the Ministry of National Planning indicates that in terms of budget allocation to development projects priority was placed on conservation (approximately 48% of total budget), followed by technical assistance and institution building projects (38%) and then by afforestation projects (14%).

Conservation programmes implemented during the above-mentioned plan period emphasized the stabilization of sand dunes in the area between Merca and Brava. Tree planting was concentrated chiefly on areas where there were ongoing programmes to assist refugee communities.

Expenditures during the 1982 - 1986 period indicate a substantial upgrading of the sector; allocation rose from less than 1% of the total development budget in 1974 - 1978 to an average allocation of 5.4% over the plan period. However, annual reviews of the economy for 1983 and 1984 indicate only modest levels for total actual expenditure in the sector, amounting to approximately SoSh 100 million; this result represents 3.5% of the total actual development expenditure for the years mentioned above.

The major constraints to development were identified as follows:

- the large increase in demand for fuel wood caused by rapid demographic increase that seriously undermines possibilities for adequate regeneration of tree growth

- the self-constrained nature of forestry activities which are implemented by specialized units and as a rule do not benefit from measures to coordinate activities with related agricultural and rural institutions

- lack of programming of follow-up activities once foreign support is withdrawn

- limited access to performance data which impedes planning.

Concerning the 1987 - 1991 plan period, the main objectives are to ensure a constant and adequate supply of forestry products and secure the active participation of the public in conservation efforts.

Policies and strategies aim at:

- conducting surveys and studies to inventory natural resources and improve the present knowledge concerning constraints to forestry development
- assisting villagers, herdsmen and urban dwellers to organize self-help groups and searching their active support for forestry development and conservation schemes
- elaborating regional master plans.

Reforestation schemes will be the principal developmental activities, followed by conservation and institution building programmes.

1.5.2 Range

The main objectives for the livestock/range sector in the 1982 - 1986 plan period were:

- to increase output of livestock products in order to meet domestic demand and to increase revenues from exports
- to improve livestock watering facilities and increase the number of watering points
- to control grazing through the assisted activities of pastoral organizations.

In terms of budgetary allocations, a very high priority was placed on modernization of the livestock industry, followed by range development and animal health.

Public investment in range development was centred mainly on two large projects; the Central Range Lands Development Project (CRDP) and the Northern Range Lands Development Project (NRDP). In their first stage those projects met with limited success. (Detailed information on those two projects can be found in Section 1.8.)

In overall major constraints in that sector were:

- projects implementation problems
- logistic difficulties
- weakness in the organization and management of project activities
- lack of mechanisms enabling the planning of follow-up activities.

The 1987 - 1991 Development Plan stresses the need to put an end to further numerical expansion of livestock. Outputs should be increased and employment opportunities created through the improvement of traditional modes of production, the present task being to consolidate appropriate pastoral production systems and aim at achieving stable long-term outputs, giving due consideration to conservation issues.

In the absence of a sufficient body of statistical data, an important element of strategy is the collection, analysis and appropriate storage of information in order to secure realistic planning and efficient management.

1.6 The National Range Agency (NRA)

The National Range Agency (NRA) was established as a semiautonomous project under the Ministry of Livestock, Forestry and Range (MLFR) in 1976. The NRA has operational departments dealing with Range and Environment; Forestry and Anti-desertification; Wildlife; Planning, Training and Research. NRA has regional and district offices throughout Somalia, with responsibilities for range reserves and for forestry nurseries and planting programmes. It is also responsible for rangeland management of the holding grounds and quarantine stations (e.g. Laheley). NRA has wide legislative powers and in principle administers all related projects.

In 1980 funds were provided to strengthen NRA. This support included technical assistance, infrastructure, vehicles and equipment and training facilities. Economic constraints have, however, caused severe pruning of the financial allocations NRA received from the GoS. The allocations were of SoSh 68 million in 1983, SoSh 38 million in 1984 and only SoSh 24 million in 1985.

The range reserves maintained by the district NRA offices are remnants of those established through the late 1970s after the commissioning of the NRA, and with WFP assistance. The objectives of these reserves were to protect areas from grazing during the rains in order to accumulate a dry season grazing reserve and to improve the range vegetation. Famine reserves were also designated for complete closure until periods of drought. The effectiveness of these reserves is low due to the difficulties of policing and management.

The NRA Headquarters houses the Somali National Herbarium. More than 14,000 specimens have been collected. Regrettably, what is unquestionably the largest and most comprehensive plant collection in Somalia, with a sound nucleus of range species, the majority of which have been authoritatively identified, is not receiving adequate professional or financial support.

The staff is composed of minimally trained personnel, and the departure of the expatriate taxonomist has resulted in a lack of direction and sense of purpose. The lack of proper maintenance has led to the presence of harmful insects and fungi. Recommendations for rehabilitation have been made by CRDP, but the situation has not improved so far. Presently, and as a consequence of this, the specimens collected by the JESS-Team are deposited at the NUS (National University of Somalia) instead of the NRA herbarium.

Overall, the general level of education, experience and devotion to duty of NRA-staff is generally low. When combined with the vast areas involved and the logistical and financial difficulties prevalent in Somalia, this has kept efficiency and results to a low level.

To cope with this, the CRDP has cut short the administrative/logistical procedures to deal directly with priority districts from Mogadishu.

1.7 The Forestry, Range and Wildlife Institute (FRAWI)

The first formal training in forestry in the southern part of Somalia, commenced when FAO established a Forestry and Wildlife School in Gunnis Forest near Giamama in 1976.

As the location of the school was considered to be rather remote, it was relocated to Afgoi in 1981.

The Afgoi Forestry and Wildlife Training Center was built by the National Range Agency and was equipped by USAID, FAO and the ODA. The Center raised the level of training from Primary to Intermediate intake, and it operated between 1981 and 1987 during which time it produced technicians and gave in-service training courses for the Forestry and Wildlife Departments of the National Range Agency.

With the closing of the Range Management School established by FAO in Burao, there became a need to include Range Management within the Forestry and Wildlife Training Center.

In April 1987 the Education and Training Section transferred to new buildings built by the World Bank and situated between Afgoi and Lafoole.

The institute was formed and has been named the Forestry, Range and Wildlife Institute. It has raised the intake level to secondary school leavers and runs diploma courses to cover range management as well as forestry and wildlife.

The main objectives are to produce technicians and middle management as well as to improve the existing supervision and management level of staffing in the Forestry, Range and Wildlife Departments.

Since 1981 a total of 76 technicians has been produced and five in-service courses have been run on nursery management, beekeeping and general management and administration procedures for National Range Agency staff.

On the practical side of the training attachments, working field trips are carried out at various forestry projects in Somalia.

From EEC funding a Forest Training Nursery was established and it produced 10,000 seedlings in 1986 and 20,000 seedlings in 1987. Then seedlings were used to set up a Forest Extension Programme to supply 10 villages in 1986 and 15 villages plus many individual farmers in 1987.

In 1987 a hedging trial to demonstrate agro-forestry and alley cropping was planted along with an arboretum containing 35 native and exotic tree species. The A.I.Farm has 160 ha of land available.

The future programme of the Institute up to 1989 includes: the first two year diploma course, the first 18-month certificate course, the first NRA District Officers course, the first one-year diploma course for NRA certificate staff as well as repeated short two- to four-week courses for NRA staff.

1.8 Forestry

1.8.1 Forest Resources

Trees and shrubs of the Juba Valley are acknowledged to be of major importance both for their use-value and for their protective function. A quantitative evaluation of the existing wood resource is difficult to achieve.

The availability of wood resources in the Juba Valley has a particularly high variability, resulting from natural and man-induced factors. Even in areas which have been little affected by cutting, such as those far from water sources and used occasionally only by nomads, the vegetation varies from low bushed grassland to rather well developed woodland. In areas close to the river, the variation is even more extreme, from cleared agricultural land to closed forest.

The Southern Range Lands Survey (SRS) of RMR [85] presents estimates of the charcoal and wood fuel resources. Those estimates were based on the following data and analysis:

Vertical aerial photographs have been taken in the land system units having trees or large bushes. These photographs (442 in number) have been interpreted photogrammetrically to provide:

- mean crown diameter
- cover of trees as a percentage
- cover of bushes as a percentage.

The cover of trees and bushes and shrubs recorded by point-intersect methods at monitoring sites and by density-matching techniques from oblique aerial color transparencies have been estimated for each land system unit and the three sets of data combined, using the 1:100,000 topographical maps to provide some idea of the area of dense woody cover in each land system unit.

Mean tree heights have been estimated from measurements made at monitoring sites, and height estimates made from the 1973 aerial photography (1 : 30,000). The data shown on the 1 : 100,000 maps are as follows:

- mean bush heights have been estimated from monitoring site measurements.

- mean crown diameter has been taken from these photogrammetric analyses.

- tree timber volume in m^3/ha is based on the following expression:

  . saw wood timber volume of an Acacia growth style tree = tree height x 0.004 x tree crown diameter to the power 1.68

  . wood fuel in m^3/ha is the addition of the residue from trees cut for charcoal, plus stems which can be cut from bushes, plus stems which can be cut from shrubs

- woody cover, bush cover, tree cover, tree timber and fuel wood volumes for each RMR monitoring sites included in the Study Area are shown in Tables 1.8/1 and 1.8/2 and Figure 1/2.

Table 1.8/1 Vegetation Cover, Tree "Timber" and Wood Fuel Volumes for each of the RMR/SRS Monitoring Sites in the Study Area - Southern Area -

Map Location No.	All Woody Cover (areal) %	Bush Cover %	Tree Cover %	Tree "Timber" Volume m^3/ha	Wood Fuel Volume m^3/ha
1	49.5	17.8	0.5	0.60	5.59
2	n.a.	n.a.	n.a.	n.a.	n.a.
3	30.4	14.2	3.8	7.13	3.72
4	60.8	45.2	8.3	16.07	10.80
5	60.8	45.2	8.3	16.07	10.80
6	58.8	29.8	5.6	9.86	7.72
7	49.5	17.8	0.5	0.60	5.59
8	49.5	17.8	0.5	0.60	5.59
9	10.4	3.8	0.2	0.58	5.41
10	6.6	3.1	0.2	0.30	0.86
11	68.5	36.0	15.1	42.42	10.79
12	n.a.	n.a.	n.a.	n.a.	n.a.
13	10.4	3.8	0.2	0.38	1.85
14	55.5	26.2	11.2	23.03	8.15
15	n.a.	n.a.	n.a.	n.a.	n.a.
16	68.5	36.0	15.1	42.42	10.79
17	68.5	36.0	15.1	42.42	10.79
18	10.1	6.8	0.1	0.34	2.69
19	55.1	24.8	8.9	18.22	7.70
20	10.1	6.8	0.1	0.34	2.69
21	47.8	19.4	2.2	7.06	7.17
22	47.8	19.4	2.2	7.06	7.17
23	52.0	21.3	2.5	5.49	5.96
24	n.a.	n.a.	n.a.	n.a.	n.a.
25	55.1	24.8	8.9	18.22	7.70
26	47.2	28.1	2.9	10.39	11.71
27	47.2	28.1	2.9	10.39	11.71

Table 1.8/2 Vegetation Cover, Tree "Timber" and Wood Fuel Volumes for each of the RMR/SRS Monitoring Sites in the Study Area - Northern Area -

Map Location No.	All Woody Cover (areal) %	Bush Cover %	Tree Cover %	Tree "Timber" Volume m^3/ha	Wood Fuel Volume m^3/ha
28	51.6	23.2	8.1	19.55	7.44
29	55.1	24.8	8.9	18.22	7.70
30	55.1	24.8	8.9	18.22	7.70
31	50.5	26.3	12.1	22.04	7.42
32	61.7	31.3	6.2	11.57	9.94
33	61.7	31.3	6.2	11.57	9.94
34	55.9	39.8	1.3	2.02	9.35
35	61.7	31.3	6.2	11.57	9.94
36	55.1	24.8	8.9	18.22	7.70
37	61.7	31.3	6.2	11.57	9.94
38	47.2	28.1	2.9	10.39	11.71
39	64.9	33.6	5.5	14.63	13.51
40	64.9	33.6	5.5	14.63	13.51
41	54.0	33.4	2.7	7.23	10.93
42	54.0	33.4	2.7	7.23	10.93
43	41.3	21.6	1.4	3.95	6.34
44	62.4	27.5	12.1	34.39	13.46
45	31.1	14.4	1.4	2.89	4.79
46	49.0	21.8	7.3	17.17	7.60
47	27.1	11.2	1.6	8.67	6.38
48	58.8	34.7	4.2	9.99	9.74
49	54.0	33.4	2.7	7.23	10.93
50	27.1	11.2	1.6	8.67	6.38
51	31.1	14.4	1.4	2.89	4.79
52	53.5	20.8	4.6	12.16	10.91
53	62.4	27.5	12.1	34.39	13.46
54	31.1	14.4	1.4	2.89	4.79
56	55.6	21.5	5.3	21.31	10.00
57	27.1	11.2	1.6	8.67	6.38
58	31.1	14.4	1.4	2.89	4.79
59	n.a.	n.a.	n.a.	n.a.	n.a.
60	25.4	10.5	1.2	2.60	3.87
61	55.6	21.5	5.3	21.31	10.00

It must be noted that the estimates of RMR-SRS do not take account of the species composition of the trees and shrubs studied, or whether they are or can be readily used for timber, charcoal of firewood. Nevertheless, if the totals for timber and fuel wood are added together they give an estimate of the total woody biomass irrespective of potential use.

The RMR-SRS estimates have been compared with the early and provisional calculations of wood biomass made by members of the British Forestry Project Somalia. The British team's results include data for total tree and shrub biomass as well as the biomass of woody material larger than 5 cm diameter. It appears that the RMR-SRS estimates are somewhat higher than the British team's results.

The units used in the present document as well as by the JESS-project for classifying and mapping the vegetation are more uniform with respect to plant biomass, although they also inevitably include substantial variation due to the use of a few units of classification to divide a broad continuum of vegetation densities.

Taking into account the estimates of wood biomass made by the JESS-team, Table 1.8/3 presents the total amount of estimated wood biomass in the Study Area, divided by districts and land use units.

1.8.2 Uses and Products of the Forest Resources

Uses and products of forest resources in the Juba Valley can roughly be divided into several categories.

Firewood

The overwhelming majority of Juba Valley residents use only firewood for cooking. However, in most towns and villages most of the firewood used consists of dead wood, often long dead. It may happen that firewood collectors cut some live trees and branches to be left to dry for future collection and use, but this is not always the case, and in many areas there is plenty of dead wood available. The wood used is of high density, almost all from Acacia, Terminalia and a few other genera.

Surveys conducted by the JESS-team have indicated that most firewood users in villages and towns from Bardheere to near Jilib obtain firewood by collecting it from nearby bush lands and woodlands, and that this work typically takes from 1.5 to 3 hours on each occasion, two or three times a week. Some town residents buy firewood from dealers who arrange collections by lorry from greater distances. On the whole, good firewood appears to be still abundant in relation to overall demand. However, in places where local population has grown importantly, the local demand is very high and the impact on the resource correspondingly more severe. This is particularly true where refugee camps are so closely concentrated that areas used for collecting firewood overlap. This is the case in Luuq where several refugee villages and the town itself lie within 1 - 3 km of each other. In that area woody biomass has rapidly declined, people have to walk increasingly long distances to collect firewood and the preferred and more efficient fuels are increasingly unavailable. Around these centers of population, preferred resources of firewood and of all other woody resources have been severely depleted and locally eliminated within several kilometers.

Table 1.8/3 Extent of Vegetation Categories (in km2) and Estimated Biomass of Wood ('000 t) in the Study Area

Category	Wood Biomass (t/ha)	Districts																	
		Bardheere		Dinsor		Saakow		Bu'aale		Afmadow		Jilib		Jamaame		Kismayo		Total	
		Area	Wood Biomass	Area	Wood Biomass	Area	Wood Biomass	Area	Wood Biomass	Area	Wood Biomass	Area	Wood Biomass	Area	Wood Biomass	Area	Wood Biomass	Area	Wood Biomass
Forest: land with a closed or almost closed canopy of trees of 10-40 m high, with a more open understorey of smaller trees and shrubs, with little grass	30 - 200	1	11	-	-	1	12	16	184	-	-	1	11	1	12	-	-	20	230
Bushland: land carrying shrubs up to 6 m high, with a canopy cover over 20%, interspersed with open grassy areas	3 - 9	1,640	984	955	573	3,105	1,863	2,825	1,695	4,255	2,553	4,027	2,416	452	271	2,938	1,763	20,197	12,118
Open Bushland: land with over 20% canopy cover formed by trees or tall shrubs of 10-15 m high, with a variable amount of smaller shrubs and a ground cover of grasses and forbs	10 - 25	2,393	4,188	1,295	2,266	1,570	2,747	2,128	3,724	1,134	1,985	154	270	-	-	-	-	8,674	15,180
Grassland: Land dominated by grasses and herbacious species, with a canopy cover of trees and shrubs of < 2%	0 - 1	-	-	-	-	-	-	-	-	-	-	82	4	135	7	202	10	419	21
Bushed Grassland: grassland with shrubs, some trees, scattered or in groups with a canopy cover of up to 20%	1 - 5	-	-	-	-	133	40	86	26	106	32	64	19	319	96	189	57	897	270
Bushland Thicket: bushland in which shrubs form an almost full cover, difficult to penetrate, with few open grassy areas	6 - 12	-	-	63	57	3	3	83	75	16	14	18	16	-	-	41	37	224	202
Woodland Thicket: closed woodland in which the trees and shrubs together form a complete cover, difficult to penetrate, with few grasses	18 - 40	-	-	78	226	126	365	124	360	37	107	-	-	-	-	-	-	365	1,058
Bushed Duneland: confined to coastal dunelands	3 - 6	-	-	-	-	-	-	-	-	-	-	-	-	132	59	11	5	143	64
Total		4,034	5,183	2,391	3,122	4,938	5,030	5,262	6,064	5,548	4,691	4,346	2,736	1,039	445	3,381	1,871	30,939	29,143

Another region of serious resource depletion is where recent concentration of population, near intensive agricultural development areas in Jilib and Jamaame Districts, has occurred. It appears that many of the lowest paid agricultural workers, as well as smallholders, depend on local firewood collection by family members and that it is reportedly not uncommon for people to have to walk 2 hours to find suitable firewood.

There have been no measurements of local fuel consumption in the Juba Valley. A survey conducted in 1986 by "Volunteers in Technical Assistance" [29], an US NGO, showed that fuel wood consumption per capita per day for Gedo Region and Lower Shebelli Region ranked from 0.943 kg to 1.121 kg and from 1.037 kg to 1.192 kg respectively. Given that firewood is not in short supply over most of the Juba Valley area, the consumption can be estimated to be 1.5 kg/per capita/per day which is about 550 kg or the equivalent of a bit less than 1 m^3 per capita per year.

House Construction

House construction requires large quantities of long, thin sticks and poles, and some thicker posts and poles. Typical houses require from several hundred to a few thousand poles, mainly of 24 m in length and 24 cm in diameter amounting to 2 - 4 m^3. in total. Usually well constructed and maintained houses last for up to 30 years without major additions or replacements of poles. As a consequence, the annual average consumption of building poles per person is much lower than for fuel and can be estimated to be about 0.1 m^3 per person per year.

Building poles have a high use-value and command higher prices than fuel wood. They can more readily carry the cost or labour of being transported over longer distances. The pole resource is widely available. Pole cutting affects forests resources over much wider areas than family collection of firewood, while annually removing quantities are much smaller, both overall and per unit area affected.

Charcoal

Charcoal producing is not a very important activity in the Juba Valley area. At present only a small proportion of town dwellers use charcoal.

It appears that charcoal available for sale in all district headquarters towns is produced locally, mainly within 10 - 20 km of each town. Often it is associated with clearance of forest of tall Acacia stands for cultivation but also occurs elsewhere in forest and woodland. Only a few species are used for charcoal and often only in the form of dead wood. It can be said that so far charcoal making has a minor impact on the total forest resource in the Juba Valley.

Charcoal makers with high outputs (e.g. cooperatives) use very efficient techniques and the rate of conversion of wood to charcoal is estimated to be close to 40%. In that case it is impossible to hope for improvement in charcoal-making efficiency.

The neighbouring Bay Region is the main supplier of charcoal to Mogadishu town and by far the largest charcoal producing region in the country. Although the official figures show that annual consumption in the capital city is about 60,000 t, it is highly probable that the actual consumption is much higher. Given that the present population of Mogadishu amounts to at least 800,000 people and assuming that 95% of the population is using charcoal, the mean consumption would be 0.216 kg/capita/day whereas the survey conducted by Volunteers in Technical Assistance showed that average charcoal consumption in Mogadishu was almost four times higher (0.817 kg/capita/day).

The increasing demand for charcoal combined with the decreasing availability of Acacia bussei (the main species used for charcoal) could lead to a shifting to other species and to increased areas in the Upper Juba Valley being exploited by charcoal makers. This situation should be closely monitored.

The Use of Large Trees

Large trees are mainly used for canoe building and carpentry. Those trees usually grew in closed forests and reduced riverine forest areas. Their availability has decreased. Canoes are built mainly out of Ficus sycomorus and Mimusops fruticosa. Local carpentry includes the making of doors, chairs and tools. In almost all the towns and villages there are wood workers and carpenters. They use a variety of timbers, often from trees already cut for agricultural clearing and the total wood resource available for carpentry is probably being steadily reduced by the extension of cultivation. Overall the amount of carpentry activities appears to be small and most probably does not have a significant impact on forest resources.

Large trees are also used locally for making beehives (Dobera and Hyphaene) and mortars (Dobera).

Other Uses

Thorn fences also consume large quantities of branches, shrub stems and regrowth. Almost all thorny or spring plants are used, especially Acacia, Balanites, Commiphora and Ziziphus. Enclosures are put around cultivated areas and around private land valued for grazing. The thorny branches used are not appreciated for fuel. The total wood resource in use for fences is probably of the same order of magnitude as the consumption of building poles and charcoal wood. The impact of cutting is restricted to the immediate vicinity of the fencing, and branches are not transported long distances. Apart from areas with a high proportion of fenced agricultural land, the effects of fencing on regional resources can be considered as insignificant.

Of local importance are also the following products: edible fruits, fibers, medicines, tool handles, etc. They do not represent large volumes.

1.8.3 Trends in Forest Resources

The total quantity and the average stocking of the forest resources in Juba Valley have been reduced, but to varying extents in different parts. Over very large areas, absolute and proportional reductions in biomass have been small, and most areas probably carry at least 50% of their potential (and past) maximum. Over significant areas within a few kilometers of towns, villages and agricultural areas near the river, the resource has been more severely reduced, to perhaps 10 - 40% of the stocking which the areas could carry, and probably did carry a few decades ago when settlements were fewer and smaller and the total settled population much lower than at present. In a few areas, notably within a few kilometers of certain concentrations of refugee villages and major watering points, woody vegetation has been reduced to an even smaller proportion of its previous stocking, although even in these areas there are usually some trees or shrubs except in the most severely affected core of the area.

The most severe reductions in the local biomass (although not necessarily the worst in terms of the size of the remaining resources or the environmental risks) are in the closed forests and *Acacia tortilis* and *A. zanzibarica* woodlands in the immediate vicinity of the Juba River and other important drainage lines. It is clear from reports, photographs and continued observations that these communities have been greatly reduced in area and density by partial and complete clearances, often associated with permanent and temporary cultivation. This clearing is important even though these areas still often carry a large stocking of shrubs and trees, as regrowth or as partly cut or lopped trees. It is assumed that some areas of woodland now being cleared for cultivation will regrow by natural regeneration. Also shifting cultivation does not necessarily result in irreversible degradation, as long as the fallow period is long enough.

1.8.4 Forestry Activities

A District Forestry Officer is stationed in each district and a Regional Forestry Officer in each region. They are subordinated to the Forestry Department of the National Range Agency. Most of these staff have had some technical training in the existing or previous forestry training schools in Somalia, and occasionally abroad.

Forestry Officers have a variable amount of tools and equipment and some have basic office facilities. Transport is a problem everywhere and even where there are vehicles, the budget allocated is not sufficient to allow proper maintenance or servicing.

Forest guards and forestry workers are employed in all districts according to local resources and work programme. The exact number of staff is not known, apparently not even from the Forestry Department, and presently a survey is being carried out by the British Forestry Project, Somalia, in order to fill that gap.

The main activities are:

- production and distribution of seedlings
- planting and maintenance of plantations
- control and supervision of dealers and producers of fuel wood and char- coal
- protection of forest reserves
- promotion of tree planting in towns an villages.

In most districts, distribution of trees to householders for planting takes place mainly for the annual tree planting day in April. Shade and fruit trees are most favored, but at present, extension programmes to promote farm planting in shelterbelts and agro-forestry systems are practically not existing with the exception of the refugees settlements near Luuq.

In 1987, the Regional NRA Coordinator started a programme of Community Tree Planting (CTP) as well as sand dune fixation. So far three plots of 600 m^2 each have been planted in the Communities of Canjell, Midho and Bibii.

The main species planted are Azadirachta indica and Eucalyptus camaldulensis. Sand dune fixation is carried out in Yontoy and in Kismayo town.

The sand dune activities are by far more successful in Yontoy where the participation of local population has been secured. Overall, the ongoing programmes could be expanded providing that financial and physical inputs are made available.

In Juba Valley most of the seedlings are produced by the NRA nurseries which are located in Bardheere, Saakow, Bu'aale, Jilib and Jamaame.

The nursery of Bardheere was established in 1982, beside the river a few kilometers outside the town. It is equipped with a water pump feeding irrigation canals. There is no building, and it is enclosed by a thorn-branch fence.

The nursery of Saakow was first established in 1979 close to the government rest house. It was moved later on to a small plot near the town water pump with a temporary thorn-branch fence. There is no building, and there are very few hand tools.

The nursery of Bu'aale, which was established in 1978, is by far better equipped than the two above-mentioned nurseries. It is situated next to the river and has permanent buildings, stores and fencing. The equipment comprises a pump and hand tools. There are irrigation channels and well established plots of Tectona, Conocarpus, Entandrophragma and Azadirachta.

The nursery of Jilib was established in Alexandria about 30 years ago. It appears that the water pump broke down some years ago. Hence, seedling watering is done by hand.

The nursery of Jamaame was established beside the river, several kilometers outside the town. There are no buildings. There is a very well kept plantation nearby with different species, and several trials of intercropping are carried out.

In general, the basic principles of nursery practice are known and put into effect. However, it has been impossible to obtain information on germination and seedling survival rates. Furthermore, there is no real follow-up after the planting. As a consequence it is impossible to have a precise idea on the number of trees planted and on survival and growth rates. Seeding timing is generally poor and does not take into account the differential seedling growth rate anterior to the planting period.

Some NGOs are carrying out some forestry activities in Juba Valley as well, mainly in the Luuq area.

The Church World Services Refugee Forestry Programme established the nursery in Luuq in 1983 in collaboration with NRA and carried out extension programmes, especially in refugee villages to promote tree planting.

World Concern runs a small nursery at the Leprosy Center of Jilib. A very wide variety of trees and shrubs has been introduced for distribution, demonstration and trials. Seedlings of the most successful species are sold, and the demand is high.

The Japanese Volunteer Service in Luuq is working on agricultural programmes among refugees and maintains a small nursery. The Swedish Primary Health project in Bu'aale distributes seedlings and encourages tree planting.

An extensive agro-forestry extension programme among local farmers has been carried on between 1984 and 1987 in Luuq by the Gedo Community Forestry Project funded by USAID. This project has established a master nursery and four mini nurseries, raised block plantations on government and community lands, erected more than 150 km of shelterbelts on irrigated farms of indigenous people using fast growing exotic tree species and also assisted other international projects operating in the area in their planting programmes in refugee camps, established a forestry reserve and also trained forestry staff, farmers and villagers in nursery and planting techniques. The project has also established a demonstration plot with 45 different exotic/indigenous species. This provides field facilities for research, study, training, tree identification, familiarization of farmers and villagers with trees and their uses and benefits. This plot has now turned out to be a source of seeds of different species of dry provenance.

Some of the species used are: Acacia albida, Acacia victoriae, Acacia cyanophylla, Albizia lebbek, Cajanus cajan, Casuarina equisetifolia, Caesalpinia pulchrima, Cassia sturtii, Cassia olligophylla, Conocarpus lancifolius, Delonix regia, Delonix elata, Dalbergia sissoo, Dodonea viscosa, Eucalyptus camaldulensis (NTK), Azadirachta indica, Tamarindus indica, Terminalia polycarpa, Moringa oleifera, Leucaena leucocephala.

In summary, the project has done an excellent job towards community awareness of forestry and in motivating and involving farmers and villagers in various tree planting activities. The best results have been obtained in raising shelter belts, in form of alley cropping, in irrigated farms along the Juba River where tree survival has been over 90%. The farmers have harvested benefits from trees in the form of poles and construction materials, used green leaves and pods to graze goats and sheep during the dry season, increased yields from fruit trees due to reduced winds, minimized loss of water through evaporation (hence more water available to crops), and improved environment. The farmer also earns money by sale of leucaena poles at the market. Some farmers constructed raised platforms from trees in shelter belts to dry maize and on the ground to avoid damage from termites.

1.8.5 Riverine Forests of the Juba Valley

Up to 1920, the riverine forest cover extended along the whole length of the Juba River. Because of human activity, mainly clearance for agriculture, the area covered presently by riverine forests is reduced to small patches totalling less than 1,000 ha. Table 1.8/4 shows the decline in forest area since 1940.

The rate of loss has been estimated to be of 297 ha/year between 1960 and 1983 and of 429 ha/year during the 1983 - 1987 period.

The two largest remaining patches are the Barako Madow (100 ha) and Shoonto (250 ha) forests, both South of Bu'aale.

Botanical surveys were conducted by MADGEWICK et al in 1986 in both abovementioned forests (Somalia Research Project) [128]. The JESS team has conduc- ted botanical surveys in other riverine forest patches.

Madgewick et al encountered a total of 56 woody species: nine only occurring as shrubs less than three meters in height; a further 20 species reaching 3 to 10 meters and 27 species reaching heights over 10 meters were also recorded. The emergent trees were approximately 25 meters high. The detailed analysis of vegetation is not yet available.

Table 1.8/4 Extent and Number of Patches of Forest in the Juba Valley

	1940	1960		1983 - 1984		1987	
		Total area (ha)	No. of patches	Total area (ha)	No. of patches	Total area (ha)	No. of patches
Saakow		2,878	27	438	11	65	3
Dujuuma		3,009	23	1,361	18	505	9
Fanoole		1,658	14	549	9	163	6
Jilib		1,701	16	122	1	83	1
Jamaame		100	4	51	3	0	0
Gobweyn		n.a.	n.a.	90	2	81	2
Total	17,750	9,346	84	2,611	44	897	21

Sources: 1940: Calculation made by BOWEN et al and based on a document of R. Luchini [123]
1960 and 1987: RMR interpretation for JESS (aerial photographs).
1983/84: JESS (aerial photographs).

The following 12 species were cited by R. LUCHINI for their potential importance for timber (see Table 1.8/5).

Table 1.8/5 Tree Species of the Juba Valley Riverine Forests Valued for Their Timber

Scientific Name*	Vernacular Name
Mimusops fruticosa A.DC	Degan
Trichilia emetica Vahl.	Garomas
Acacia seyal var. seyal	Damal
Afzelia quanzensis Welv.	Shovri
Antidesma venosum Tul.	Ghedbiod
Sorindea madagascariensis DC	Matambiod
Spirostachys venifera (Pax.) Pax	Varancole
Thespesia danis Oliv.	Cobon
Garcinea livinstonei T. Anders	Shanfarood
Hunteria zeylanica (Retr.) Thwaites	Ghedmedu
Cordia ravae Chiov.	Mererdol
Newtonia erlangerii (Harms.) Brennan	Reidap

* Scientific names updated by M.R. Bowey et al.

The JESS team found nine forest species that had not been recorded so far in Somalia among which one could be new to science (see Table 1.8/6).

Table 1.8/6 List of Juba Forest Plants Collected by JESS Which Have not been Collected Previously in Somalia

Scientific Name	Vernacular Name
Acacia elatior	Damal, dambal
Acacia rovumae	Makongowey
Olea sp.	Wabaayo booneed
Lepisanthes senegalensis	Masaar jabis
Pleiocarpa pycnantha*	Geed biyood
Monauthotaxis fornicata	Cismaan dooy
Pavetta sphacrob	Geed cade
Cola sp.*	Hiinfaal
Baphia sp.*	Geed cade

* genera new to Somalia; need further confirmation.

A zoological survey has also been carried out by the Somalia Research Project team. A total of 38 species of birds were caught and ringed among which 20 are totally dependent on riverine forest and could be lost from the country if the remaining forest is cleared or degraded. Those species are the following:

African Goshawk	Bat Hawk
Kenya Crested Guineafowl	Tambourine Dove
Fischer's Turaco	African Wood Owl
Barred Owlet	Pel's Fishing Owl
Narina's Trogon	Crowned Hornbill
Scaly-throated Honeyguide	Square-tailed Drongo
Eastern Beared Scrub Robin	Black-headed Apalis
Ashy Flycatcher	Black-throated Wattle-eye
Little Yellow Flycatcher	Crested Flycatcher
Olive Sunbird	Dark-backed Weaver

38 species of mammal, including nine species of rodents, nine species of bats and one insectivore were recorded. A number of these 38 species are rare or declining in numbers in Somalia. The Blue Monkey, Harvey's Duiker and Red Bush Squirrel are restricted to riverine forests in Somalia, the latter two species being exclusive to the Juba forests and occurring nowhere else in the country.

SRP and JESS surveys show that the products of the riverine forests can be summarized as follows:

- Wood
    - charcoal/firewood
    - wood for village carpentry/construction
    - high-value lumber for occasional village use/commercially extracted

- Rope/fibers

- Medicinal plants

- Edible fruit

- Miscellaneous products such as aromatics, dyes, glues, honey, poisons, resins, etc.

Protection of the Riverine Forests

The NRA has declared four Forest Reserves since 1982. Barako Madow and Shoonto are the two largest. Boundaries have been surveyed, mapped and marked with paint on large trees, partly following local roads. These boundaries include a few hundred hectares of closed woodland. In both forests, access roads have been cut and forest guards posted in nearby villages. Still, recently some poles were cut and removed, and small charcoal kilns have been seen.

The legal status of the unreserved patches of forest is not clear. Forestry authorities have substantial legal powers to regulate or prevent tree cutting, but in practice it is difficult for them to exert this authority.

The Ministry of Agriculture has powers to authorize cultivation without reference to the forestry authorities, irrespective of the local vegetation, and there is little effective control over clearance and cultivation occurring without official approval. Under the present circumstances there is every reason to expect that the great majority of remaining unreserved forest patches will gradually be cleared during the next few years and that unless more areas are immediately protected as Forest Reserves, there will soon be no areas worth giving special protection.

The Effects of the Bardheere Dam

The changes in the flood regime of the Juba River after the completion of the dam may have some effects on the floodplain vegetation.

If controlled floods are created, they would minimize the changes in forest composition. However, if controlled floods are not included in dam operation schedule, the forest environments will be affected in several ways. The groundwater table will be changed becoming more constant and at a lower level. Surface-rooting plants will have less access to water. It is likely that larger trees will continue to have access to adequate water, but seedlings may be adversely affected by the lowered and more constant water table. An absence of floods will eliminate the deposition of nutrient-rich sediments on forest soils. The width of the forest could be reduced and the diversity of plants could decline because of the lack of floods. The forest will also be accessible to people and livestock for longer periods of the year leading to an increased forest destruction.

Conclusions and Recommendations

The remaining small areas of riverine forest in the Juba Valley are rapidly being degraded by wood-cutting or cleared for agriculture. If the demand for grazing, wood products and farmland continues to grow, and if NRA cannot protect them adequately, they will quickly be degraded and eliminated. The remaining riverine forests provide sites of very great potential value for research, training, education and gene conservation.

A plan of action has been suggested by SRP and support for it has been voiced by Somali Government agencies, USAID, the British Forestry Project Somalia (ODA) and SES (Somalia Ecological Society). The plan of action recommends that protection of Shoonto and Barako Madow Forest reserves be strengthened and that NRA presence on the ground be increased. No further tree cutting should be allowed and any existing licenses revoked. Local people should be educated and consultation over traditional use of the forest by local inhabitants should take place to prevent over-exploitation. Data should be collected on medicinal and other uses of forest products. International support should be sought for the construction and operation of a Study Center for research and education. Additional surveys should be undertaken in order to prepare detailed plans for future management.

In 1987, SES put forward a proposal for managing the reserves and was seeking financial support from the Somali Government, World Wildlife Fund for Nature (WWF) and USAID.

From the institutional point of view it is essential that close cooperation exist between NRA, the Ministry of Agriculture and the Ministry for Planning and Juba Valley Development as well as effective channels of communication with field officers.

1.8.6 Conclusions

The total of all forest resources in the Juba Valley and its potential sustainable annual production are very large in relation to the present internal demand and consumption. However, in areas of large concentrations of population, as around groups of refugee villages and agricultural projects, yields of wood from the natural vegetation within easy walking distance are inadequate to supply the local needs. The difficulties in obtaining firewood and the deterioration in the local environment are severe and getting worse.

Supplies of poles, charcoal and firewood can be sustained without environmental deterioration if they are transported over longer distances. In the case of large trees for carpentry, supplies are now so reduced that future demand cannot be satisfied from local resources.

The remaining small areas of riverine forest in the Juba Valley are rapidly being degraded by wood cutting or cleared for agriculture. If present trends continue, most of these forest patches will be cleared within the next few years.

Shoonto and Barako Madow forest reserves are protected by NRA. As a result, current levels of human interference and of browsing by domestic and wild animals are not a threat to the continued existence of the forest. However, the survival of the forests will depend on continued adequate protection from fire, cutting and livestock.

If the demand for grazing, wood products and farmland continues to grow, and if NRA cannot protect them adequately, they will quickly be degraded and eliminated. These two remaining forest reserves are almost intact and are unique in Somalia. They provide sites of very great potential value for research, training, education and gene conservation. The expenditure needed to protect them is fully justified.

Planting of shade trees and fruit trees is understood and practiced throughout the Juba Valley, even in the smallest villages, although often on a very small scale. A very large number of tree species have proved themselves suitable and successful in many areas. Intensive extension activities have had conspicuous success around Luuq. All districts have staff experienced in raising trees.

Local NRA nurseries range from apparently busy and resourceful ones (Luuq, Bu'aale, Jamaame) to relatively unproductive nurseries.

1.9 Range

1.9.1 Changes in Land Use And Vegetation Physiognomy

In the NTTCP/LUS [40] report an assessment of changes of land use in the southern rangelands has been made for the period 1960 to 1983. It has been based on comparison of the LUS interpretation of the 1983/84 photography with FAO/Lockwood interpretations of the 1960 photography as well as with their own interpretation of the HTS (Hunting Technical Services) 1960 1 : 100,000 mosaics. It shows that there has been an increase in the percentage of land in the cultivation cycle in all land regions particularly in the Upper Shebelli and Shebelli floodplain regions and in the lower Juba. Between 1960 and 1983, the percentage of land in the cultivation cycle has doubled in the lower Juba flood plain, reducing subsequently the areas of rangeland. In the Trans-Juba plains the same percentage has been multiplied by four. It shows that already well established cultivated areas have continued to expand but not as fast as in newly pioneered regions (e.g. northwest of Kismayo). The overall annual increase rates of cultivated land appear to have been similar to the apparent rates of increase in human populations and, therefore, similar continued rates of expansion may be expected in those regions with relatively low percentages of the land at present in the cultivation cycle, particularly where good soils are still available and rainfall is adequate.

In the remaining rangelands there are indications of a change in the vegetation composition. For grasslands, for instance, there is consistent evidence in all regions of a reduction in the proportion of grassland in rangeland between 1960 and 1983. The proportion of shrubbed or bushed grasslands has also declined. Given these changes, the proportion of shrub land and bush land in the rangeland has increased. In the lower and Trans-Juba areas there has been a substantial shift from dense to open bush land. In the lower Juba flood plain the percentage of rangeland area covered with shrub and bush grassland went from 7 to 9% while that covered open shrub land and bush land increased from 9 to 33%. During the same period, shrub and bush land decreased from 71 to 52% and thicket from 12 to 7%.

Further investigation is required to establish the validity of these apparent changes and to identify the reasons why they occur.

Estimates of the present condition of rangelands have been made by RMR/SRS. These studies have included objective measurements of vegetation types, species composition, and ground and aerial cover. Of these measurements, ground cover (defined as the percentage ground cover of grasses and herbs derived by point intersect methods) and aerial cover (defined as the percentage aerial cover of all vegetation, including grass, herb, shrub, bush and tree canopy cover) have been defined as the most objective indicators of rangeland condition.

RMR/SRS considered vegetation physiognomic types to be relatively uniform within their Land System Units (LSU). As an indication of range condition in these units, therefore, average ground and aerial cover percentages were calculated by NTTCP/LUS from the individual monitoring sites. In order to reduce the variability of these measures, records were only included in these averages for field surveys undertaken in the dry seasons or very early rains before substantial vegetation growth had occurred. In general, the measures showed consistent differences between LSUs in ground and aerial cover.

An attempt was then made to identify those areas of rangeland in relatively poor condition, defined as having both particularly poor ground and sparse aerial cover, and those in relatively good condition with good ground and aerial cover.

NTTCP/LUS came to the conclusion that as a preliminary indication, the rangelands with the poorest vegetation cover occur in areas of low rainfall or are very heavily used and that the rangelands with the greatest ground and aerial cover occur in areas of higher rainfall and that some of them are relatively under-used.

Some areas like the band of rangeland inland of Kismayo are moderately used, though mainly as dry season rangelands so that they have some chance to recover during the rains.

A tentative comparison between livestock stocking densities and rangeland use was made. In general, the use of areas with poor vegetation cover tends to be heavier in the wet season than in the dry. The average biomass stocking densities for all LSUs with less than 10% ground cover and less than 40% aerial cover were 8,565 kg/km^2 in the wet season compared to only 4,632 kg per km^2 in the dry season. Conversely, most of the LSUs with high vegetation cover are used primarily as dry season rangelands with an average wet season stocking density of only 3,463 kg/km^2 compared to a dry season density of 8,293 kg/km^2.

It was concluded from these analyses that some rainy season rangelands, particularly in low-rainfall areas, may be in poor condition and require further study as a priority. Other areas that may be undergoing degenerative changes are rangelands with poor ground cover and moderate to good aerial cover. The combination of poor ground cover and dense aerial cover may occur in relatively stable vegetation types, such as coral thicket, wooded thickets and riverine thicket, or alternatively in shrub lands and bush lands in which heavy grazing has reduced ground cover by herbs and grasses, thereby reducing the incidence of fire and allowing increased bush encroachment.

The rangelands in relatively dry areas such as those in the upper Juba area and those in the moderate rainfall areas of the interriverine basement and colluvial slopes, which are used mainly in the wet seasons, may be in a more fragile condition with a trend to increased density. These should also be priority areas for further attention to establish their condition and trend.

1.9.2 The Riverine Rangelands

Special attention has been paid to the riverine rangelands as their use in the dry season is a vital component of the overall rangeland grazing system of southern Somalia. Despite the presence of tsetse fly, the dry season stocking densities in these areas are very high and generally much higher than in non-riverine rainy season rangelands.

Table 1.9/1 summarizes the location, land use, tsetse infestation, vegetation and seasonal stocking densities for the riverine rangelands of Juba Valley.

Table 1.9/1 Location, Land Use, Tsetse Infestation, Vegetation and Seasonal Stocking Density in Riverine Rangelands*

Location of LSU	LSU area	Land in rangeland	Seasonal or permanent floodland	Tsetse infestation		Range land vegetation		Biomass stocking densities, kg/km^2	
				Overall infestation	Heavy infestation	Average ground cover %	Average aerial cover %	Dry season	Rainy season
	km^2	%	%	%	%				
Bardheere to Saakow, river valley alluviums within 2 km of river	132	56	2	50	0	11	55	26,215	16,148
Bardheere to Saakow, plains 2 - 20 km from river, mainly east bank	1,572	68	0	2	0	10	35	9,692	5,867
Saakow to Fanoole, river valley alluviums within 2 km of river	284	82	15	100	100	13	68	9,945	203
Saakow to Fanoole, plains 2 - 10 km from river, both banks	956	0	98	5	5	14	56	5,943	1,956
Saakow to Fanoole river and deshek fringe areas	208	52	2	100	100	n/a	n/a	10,834	0
Saakow to Fanoole deshek and swamp areas	476	0	100	100	90	25	87	13,921	0
Fanoole to Sunguni, river valley alluviums within 5 km of river	364	61	10	100	100	66	83	14,095	1,545
Fanoole to Sunguni, plains 5 - 15 km from river, west bank	828	88	1	100	100	54	65	9,516	2,412
Mareere and Jilib plantation and irrigation development	100	3	0	100	0	n/a	n/a	3,442	586
Kamsuma to Gobweyn, river valley alluvium with 2 km of river, west bank	220	43	5	100	100	31	87	26,741	3,769
Sunguni to Gobweyn, river valley alluvium within 2 km of river, east bank	128	92	6	60	60	n/a	n/a	23,738	12,294
Jamaame area, grasslands	256	98	0	25	25	9	39	15,681	20,674
Deshek Waamo fringe valley	100	80	15	95	20	16	35	70,492	67,765

* Based on the RMR/SRS and NTTCP/LUS report.

Reference to the seasonal biomass stocking densities of those areas illustrates their great importance. Tsetse infestation does not generally appear to greatly affect the use of these rangelands. Even some areas with a large extent of relatively heavy infestation may be heavily stocked, though stocking densities in these areas might be even higher than at present in the absence of tsetse infestation. Riverine rangelands in the Juba Valley appear to be generally less heavily used than in the Shebelli and are also generally more heavily tsetse infested.

In general, when compared to non-riverine, rainfed rangelands, ground and aerial cover appear to be good. This appears to be the case even where the riverine rangelands are used in both rainy and dry seasons, except for areas in the immediate vicinity of major river watering points. Good vegeta- tion cover occurs particularly in the seasonally flooded areas where access may be restricted in flood seasons, though the quality of herbage may be relatively poor in some of these areas, until burning or heavy grazing has removed some of the older dead vegetation. In general, it appears that most of the riverine rangelands can absorb present stocking densities without deterioration, providing the seasonal pattern of use mainly in the dry seasons is maintained. It should be noted, however, that relatively few vegetation monitoring sites have so far been studied in riverine rangelands. It is hoped that that gap will be filled, at least partially, by the research programme initiated by the JESS team.

1.9.3 Carrying Capacity

All estimates of livestock carrying capacity in southern Somalia were made by FAO/Lockwood (1967), the NRA (Field, 1980), FAO (1981) and by RMR following the Southern Rangelands Survey (Watson and Nimmo, 1985) (see Table 1.9/2). All those estimates have been constrained by the lack of data on the primary production of consumable herbage from rangeland vegetation in southern Somalia. The only estimates of primary production are those of FAO/Lockwood, based on grass and herb cutting after one rainy season and some limited observations by NRA at War Maxan ranch. Since 1986, the JESS team has started making measurements of herbaceous standing crops on permanent sites located downstream of the dam site, in and out of the flood plain, as well as upstream of the dam site.

Additional data are available from northern and central Somalia but there are major differences of vegetation physiognomy, soils and rainfall between these areas.

Table 1.9/2 Estimates of Primary Production of Rangeland Vegetation in Gedo, Middle Juba and Lower Juba Regions

Administrative	FAO/Lockwood (1967) Land Region	Average annual rainfall mm	Estimates of primary production of rangeland herbage: FAO/Lockwood (1967) kg DM/ha	FAO/Lockwood (1967) kg DM/ha/mm rain	NRA/Field (1980) kg DM/ha	NRA/Field (1980) kg DM/ha/mm rain	Watson and Nimmo (1985) kg DM/ha	Watson and Nimmo (1985) kg DM/ha/mm rain
Gedo	Mandera-El Wak Uplands	300	139	0.5	383	1.3	640	2.1
Middle Juba	Fafadun Plain	350	398	1.1				
	Marine Plain	600	481	0.8				
		450			519	1.2	740	1.6
Lower Juba	Dudumali Plain	500	287	0.6				
	Lower Juba Flood Plain	600	793	1.3				
		550			677	1.2	805	1.5

In his report on "A preliminary assessment of herbacious standing crops in the Juba Valley", Ian Deshmukh (JESS team) indicates that downstream of the dam site the overall mean standing crop for grasses and forbs in the non-flood plain was of 700 kg/ha in July/August 1986, 450 kg/ha in January to March 1987 and 300 kg/ha in August 1987. Deshmukh indicates also that most sites south of the Fanoole Barrage have a noticeably higher mass of herbaceous plants than those in the northern part.

On average, the floodplain sites support more than twice the standing crop as compared to the non-floodplain sites. The average mass of herbaceous plants was more than 1,900 kg/ha in July - August 1986, 1,240 kg/ha in January 1987 and 940 kg/ha in March 1987. Unlike the non-floodplain sites, there appear to be no clear-cut regional differences in floodplain herbace- ous standing crop whether in a North-South direction, or as compared to the different physiographic units mapped by AHT.

Table 1.9/3 Estimates of Stocking Rates in Relation to Livestock Carrying Capacity for the Gedo, Middle Juba and Lower Juba Regions (1)

Region	Mean annual rainfall (mm)	Forage dry matter required by livestock expressed in % of forage production		
		FAO/Lockwood (1967)	FAO (1981)	Watson and Nimmo (1985)
Gedo	377	230	197	42
Middle Juba	460	56	126	40
Lower Juba	561	87	176	84

1) Derived from data prepared by Watson and Nimmo (1985) and the NTTCP/LUS report.

In the case of FAO/Lockwood, the carrying capacity of the grass and herb layer (see Table 1.9/3) was only related to the then current stocking densities of cattle alone, ignoring the intakes of camels, sheep and goats. Browse was not considered either. Their conclusion was that overall in southern Somalia current stocking densities of cattle in the early 1960s were generally about the level of the carrying capacity of the rangelands, though some regions were overstocked. In their report, Field (1980) and FAO (1981) concluded that stocking densities in the late 1970s (based on the 1975 census) were twice or three times higher than the long-term carrying capacity. However, Watson points out that Field's estimates are too low, referring only to grasses, dwarf shrubs and small shrubs. Furthermore, Field considered that "non-herbaceous" vegetation makes up 70% of the diet of camels, 10% of cat- tle, 30% of sheep and 60% of goats, but the non-herbaceous component of diet can easily exceed these proportions.

Better estimates of the intake of browse have been included in the more recent estimate of carrying capacity based on the RMR survey data (Watson and Nimmo, 1985). Working with data on primary forage production from all herbage and browse up to 2 m in height derived from the northern rangelands, and assuming that the different livestock species consumed different proportions of this layer of forage in their diets (cattle 80%, camels 20%, sheep 70% and goats 30%), and that the remainder of intake requirements were provided by browse above 2 m in height which was not limited in supply, Watson and Nimmo concluded that overall stocking densities in southern Somalia in 1983/84 were about 64% of carrying capacity. Watson and Nimmo suggested that, of the administrative regions of Southern Somalia, only Lower Shebelli region was overstocked, with Middle Shebelli and Lower Juba regions also moderately heavily stocked at about 80% of capacity.

Basic data assumed by Watson in his estimates of carrying capacities are shown in Table 1.9/4.

Table 1.9/4 Basic Date Used by Watson and Nimmo (1985) to Estimate Carrying Capacities in the Southern Rangelands

Species	Population mean live-weight (kg)	Proportion of browse from bushes and trees in diet	Maintenance diet requirement in dry matter as % of body weight per day	Annual dry matter requirement per beast from lower vegetation ("herbaceous layer)	Annual dry matter requirement per beast from "non-herbaceous layer"
Camels	304	80%	2.3	510	2,040
Cattle	180	20%	2.5	1,314	329
Sheep	18	30%	2.4	110	47
Goats	18	70%	2.3	45	105
Donkeys	200	20%	2.6	1,518	380

However, it should be noted that Watson's estimates do not include crop residues and showed the highest rates of stocking in relation to carrying capacity in the main agricultural regions.

1.9.4 Carrying Capacity Assessment

Clearly any model of rangeland production in an environment like southern Somalia must involve a number of oversimplifications and assumptions on the extent and productivity of different types of rangelands and on the diets and intakes of the different livestock species. Many of these factors are unknown for southern Somalia and should be studied in rangeland research for the area.

Apart from the great difficulties of estimation of carrying capacity through measures of primary productivity of the different rangeland and other forage resources (including crop residues, irrigated fallow, canal-bank and swamp-fringe grazing), there are also difficulties of interpretation of these estimates in comparison to actual stocking densities. The livestock populations observed in the different rangeland areas are dependent on the climatic conditions in the seasons or years of observation. The distribution of livestock in particular non-average rainfall years will not necessarily reflect the carrying capacity of rangelands and may result in misleading interpretations of over- and understocking in some areas.

In semi-arid areas there is also a cyclical (though not necessarily regular) fluctuation in livestock populations depending on the occurrence of periods of reasonable rainfall and the incidence of drought. During drought periods, the carrying capacity of the rangelands (in terms of primary vegetation productivity) may decline to less than half the level in years of average rainfall, and the degree of overstocking will rise. Reductions of livestock populations by up to 30% may occur in these situations through mortalities and increased emergency sales. In subsequent drought-recovery periods of normal rainfall, stocking densities will naturally be less than carrying capacity until populations have recovered.

It should also be noted that the carrying capacity of rangelands differs for different species of livestock, and that to some extent the species composition of the livestock biomass and seasonal patterns of use determine the extent to which rangeland resources are used, altered, depleted or damaged. Range lands may thus appear to be used at less than their carrying capacity while still undergoing deleterious changes in vegetation physiognomy.

For these reasons it is unlikely that satisfactory measures of carrying capacity can be developed and interpreted for much of the southern rangelands of Somalia. It is probably more important that range condition, trend and livestock populations, distribution and movements be monitored over time, so that changes, and especially long-term, irreversible degradation in the rangeland vegetation can be measured objectively and the reasons for such changes established.

1.9.5 The Effects of Tsetse Eradication

According to the NTTCP/LRDC report [40] the present trends in agricultural development and rangeland use will continue regardless of the presence or eradication of tsetse fly.

When completed, eradication may have some additional effects on land use but these are likely to be minor in comparison to the overriding effects of human and livestock population expansion and settlement. Nevertheless there may be some changes in the seasonal patterns of grazing land use and in livestock ownership and management in riverine areas. Changes in livestock ownership would principally involve the riverine Bantu farmers who presently own very few animals. These changes are likely to be small. The riverine farmers have little tradition of livestock keeping, relatively small incomes to invest and relatively little labour available for livestock management. Increases in this livestock population will, therefore, be small and slow.

Changes in the seasonal patterns of use of the riverine rangeland by livestock could be of more significant importance. The extent of these changes depends mainly on the influence of constraints other than those related to the presence of tsetse flies. It appears so far that the present patterns of movement are determined largely by considerations of forage and water availability. There are a variety of reasons for the return to non-riverine rainy season rangelands such as the need for fresh grazing and the desire to avoid biting flies as well as tsetse flies. Presently access to riverine rangelands in the wet season is also hampered by waterlogging and flooding from the river. This could be a less important obstacle after completion of the Bardheere Dam.

Experience from preliminary tsetse control operations in the upper and middle Shebelli regions suggests that some areas were more heavily grazed and that animals camped closer to riverine rangelands and water sources. Some bush lands and thickets became accessible to camels. The more intensive use of certain rangelands might have the consequence that livestock would have to move to alternative grazing earlier in the dry season than they do presently.

In conclusion, should the eradication of tsetse fly be completed, there will be a need for close monitoring of changes in the use of riverine rangelands. In case of necessity, the identification of key dry season riverine rangelands and their incorporation into rangeland management plans could ensure the maintenance of sufficient dry season reserves to prevent the degradation of riverine rangelands.

1.9.6 Conclusions

Over the last 25 years, the gradual increase of land areas in the cultivation cycle has reduced available rangelands. Increased rates of reduction in rangeland availability must be expected in future, especially in the perspective of the Bardheere Dam construction and the subsequent expansion of irrigated agriculture.

Associated with human and livestock population increases, agricultural land development and the reduction of available rangelands, there have also been progressive changes in the nature of the remaining rangeland resource.

These changes have been brought about by human activity and livestock grazing and browsing. Thus, land clearing for cropping and fallowing, and wood cutting for fuel wood, charcoal, building and livestock enclosures has tended to open up some areas of bush land close to agricultural settlements and habitation, especially in low-rainfall areas even leading to problems of degradation and soil erosion by wind in some areas. Such trends are in association with intensively settled rainfed farmed areas around Bardheere, for instance, as well as in small areas of the Trans-Juba plains west of Kismayo. In undeveloped rangeland areas there are also trends in range condition. Preliminary conclusions are that deteriorating trends are presently evident in heavily used rainy season rangelands, particularly close to settled, mixed-farming areas. These include part of the basement plains southwest of Dinsor and some areas south of Afmadow. In these areas, heavy rainy season grazing, mainly by cattle, has resulted in reduced grass cover and a trend towards increased bush density.

These changes may be occurring partly as a result of the increased settlement of pastoralists in mixed farming systems. In these systems there may be a greater concentration and accumulation of livestock than in pastoralist systems since there may generally be less necessity to dispose of stock to generate cash for food purchases. There also appears to be a trend towards the adoption of cattle in mixed farming systems, since they are more suited to the types of forage and grazing resources available, are more easily herded than camels, and may be more tolerant of disease and environmental conditions, at least in riverine settled areas. However, the labour demands of farming restrict the availability of labour suitable for long-distance herding of livestock so that many of the cattle from mixed farmed areas graze in nearby rangelands within 20 - 30 km of the home base during rainy seasons, resulting in increasingly heavy use of these areas.

Overall, however, under present climatic conditions the rangelands of southern Somalia do not appear to be overstocked. The extent to which changes in range condition have occurred and the current rates of change are unknown. Only long-term monitoring of several rangeland sites for typical soils, vegetation communities and climates in southern Somalia can provide reliable information on these trends.

A major difficulty in determining the present degree of use of the rangelands and planning future programmes, lies in the problem of measuring the carrying capacity of rangelands. Given the complexities of rangeland/livestock ecology, the estimation of carrying capacities will remain uncertain, but for planning and rangeland management purposes it would be useful information. It would, therefore, be desirable that future long-term, rangeland studies include some measures of primary rangeland productivity in relation to soils, vegetation types, climate (particularly rainfall) and grazing or browsing pressure. Regular sample censuses of livestock populations may also be necessary in some areas in order to relate stocking densities to rangeland conditions.

2. Summary of Limiting Factors

The main limiting factors to forest and range resources conservation and optimal use are as follows:

- increase in human and animal population which puts heavier pressure on wood resources as well as on the browsing and grazing potential
- increasing land cultivation reducing the areas of forest and rangeland
- low yield of agricultural products leaving low amounts of by-products useful in animal nutrition
- lack of baseline data about range vegetation, productivity, carrying capacity which does not allow the build up of any range management concept
- absence of standards for vegetation and land use mapping making it difficult and sometimes impossible to compare data gathered so far
- lack of detailed information on use of woody forest and range resources and offtake of standing crop
- wasteful use of fuel wood due to low energy-efficient stoves
- insufficient number of nurseries and low output of those that operate
- lack of knowledge on suitable fast growing tree species
- inadequate agro-forestry practices
- limitations of the National Range Agency as a supervising body
- lack of basic infrastructure and equipment for the NRA field staff
- poor extension service and lack of a simple and clear message
- absence of a land use department and lack of clear policy on land use which, combined with the overlapping of responsibilities among institutions, leads to conflicts in land allocation.

3. Development Concept for the Forestry Sub-Sector

The development framework for the forestry sub-sector must aim at achieving the following objectives:

- satisfying the requirements of the inhabitants for wood products
- maintenance of an adequate vegetation cover sufficient to sustain the productive capacity of the soil and avoid unacceptable environmental deterioration
- long-term conservation of representative areas of rare and endangered communities of plants and animals.

To achieve this, it will be necessary to establish a management system for a stable and sustainable rate of cutting, to increase the production of wood from planted trees and shrubs and to implement effective measures of management and protection of the forest reserves (see also Volume II, Section 3.5).

Promotion of tree planting and integration in the farming system should be the cornerstone of forestry development in Juba Valley. The implementation of an agro-forestry concept is of paramount importance. The promotion of tree planting at farm level will generate additional income, fuel wood, diet diversification, fodder, stabilization of small irrigation canal structures, erosion control and soil conservation. In order to achieve its purpose, the agro-forestry programme will have to tackle with various issues including the identification of the most appropriate farming systems and/or farmers taking into consideration the priorities set by the beneficiaries themselves, the elaboration of extension messages, the setting up of demonstration plots as an element of extension and the training of personnel. The success of agro-forestry activities in Luuq District should serve as a model for extending those practices, taking advantage of the apparent increase of interest of the farmers in tree planting (mainly fruit trees so far). The expected rapid increase in farming population after the completion of the Bardheere Dam makes the issues of agro-forestry even more important. This will only be done successfully if an adequate institutional framework exists along with expanded and upgraded infrastructure and physical inputs becoming available. The screening, by means of field trials, of the best adapted tree species is a prerequisite for long-term success of such a programme but the benefit of those trials will be lost if there is no effective extension service capable of promoting and encouraging tree planting among the population as well as collecting feedback information.

In some places, like in Kismayo District, small agro-forestry activities have been initiated recently, sometimes combined with sand dune stabilization programmes. Those activities could be rapidly expanded providing there is an adequate support in terms of equipment and funds as well as some basic technical assistance.

Upgrading and extension of the nursery network comes as a top priority among the required basic structures. The location of new nurseries should take into account not only the present demand but also the expected increased needs resulting from the new farm settlements after the construction of the dam.

Once the new all-weather road between Bardheere and Jilib has been completed, easier transport, especially during the wet season, will allow access to tree seedlings to a larger section of the population. Until then, a network of "flying nurseries" should be established: before the rains begin, seedlings should be taken from the base nurseries to convenient locations, where they would be within walking distance for would-be users.

It cannot be expected that in the near future the major part of fuel wood requirements will be met through the harvesting of planted trees. Therefore, careful attention should be paid to the collection of firewood, especially in those areas where heavy pressure has been put on the natural vegetation, and where collecting sites are in increasing distance from the users' residence. Realistic measures should be identified and implemented to put an end to environmental degradation. In some cases, special provisions of wood could be made to relieve the cutting pressure. This could be done for instance, by harvesting the standing wood of the future Bardheere Dam reservoir site which will otherwise be wasted. The JESS project has made a preliminary study on that issue and has come up with the following proposals and conclusions (JESS report No. 16).

The proposed reservoir area should not present serious problems in terms of clearing woody vegetation, as dense riverine forest is not abundant. There are small pockets of riverside forest, but these should not be difficult to clear and the wood can be transported by raft to ready markets in the construction camp or Bardheere town. However, the eastern portion of the lower reservoir area has a fairly dense cover of small trees and shrubs of savanna vegetation that are typical of the region. This eastern slope is quite steep and access to it could be difficult. In addition, ephemeral tributaries (toggas) have denser woody vegetation on steep slopes, and access to these locations will be very difficult.

Since there will be increasing demand for fuel wood, MJVD should not have difficulty letting contracts or concessions for clearing. Woodcutters can easily have access to the area by boat or trails, and, as mentioned, fuel wood can be rafted to the construction site or Bardheere town. Again, people who will be displaced by inundation should receive preferential treatment in allotting clearing contracts or concessions. It would be difficult to restrict clearing activities to only those who live in the inundation zone, but they could gain preference by having access to credit to purchase simple clearing equipment or implements. They should also be given special vendors' permits to sell fuel wood at the labourers' camp.

It will be critically important to remove all woody vegetation with tops that would emerge above the minimum normal operating level of the future reservoir (128 m asl). These emergent tops create more favourable vector habitats by reducing wave action and encouraging waterweed proliferation. Experience with other tropical reservoirs clearly demonstrates the benefits of clearing woody vegetation that would emerge during reservoir draw-down. However, vegetation with root systems above the maximum normal operating level should be retained and protected to provide upslope erosion control.

Vegetation that would not be emergent when the reservoir is at the minimum water level (128 m asl) need not be removed, although it obviously constitutes a resource loss if that wood is not used as construction material or fuel wood. However, the eventual decay of such trees would provide nutrients for a developing fishery as well as creating potential spawning sites for fish. Submerged vegetation helps protect young fish from predators and over-exploitation by improved fishing gear and techniques. It is unlikely that MJVD will need to consider cutting fishing lanes as the woody vegetation is not dense enough to present future difficulties. At this point, future use of the reservoir for navigation is unclear, although it would provide easier wet-season access to settlements along the reservoir's perimeter. However, this woody vegetation will not pose obstacles to navigation and does not require further discussion.

The shallow lacustrine area may have fewer problems with emergent woody vegetation than the narrow sections of the reservoir. This area is the current site of large refugee camps, and much of the vegetation near the river has already been cut for fuel wood. In addition, the topography of this area would not handicap further clearing, since access is relatively good during the dry seasons.

In the upper reservoir area, woody vegetation is less dense, and no clearing problems are expected, except that some planted trees will need to be cleared and owners should be compensated for their value. Clearing products would have a ready market as fuel wood and building materials in the village of Luuq or at refugee camps that will not be flooded by the reservoir.

Although of less apparent economic importance, the strict protection of the remaining riverine forests is essential to salvage what has been called "a national monument for Somalia" by the Somalia Research Project, since it supports a unique combination of plants and animals, many of which will be lost if further degradation takes place.

4. Development Concept for the Range Sub-Sector

Among the means that would allow conservation, and if possible, increase in rangeland resources, proper management comes as a top priority and the early identification and incorporation into management of degrading rangelands is obviously a desirable objective. To identify the basic principles of proper management adapted to the existing situation, a sound and comprehensive knowledge of actual resources should be gained along with the identification of key parameters influencing the evolution of these resources with the aim of assessing trends and constraints.

Because no attempt has been made in the past to collect baseline information regarding the type and condition of Somali rangelands, changes over time can only be seen (and even then determination of rate and extent of change is hard) when it is very evident, as in the case of accelerated erosion.

Although the occurrence of poor condition is an indicator of changes in rangeland, trend through time is best determined by remeasurement of vegetation and soils on permanent sample plots.

Analysis of changes in land use or in rangeland vegetation types and conditions requires repeated studies using standardized methods over long time periods. This would require satellite imagery, remeasurement of permanent photographic sample plots and ground samples to relate imagery with ground/ vegetative detail. Monitoring spatial patterns of rainfall on a temporary basis and relating these with soil moisture and vegetative response (greenness, cover, production, phenology) could eventually allow predictions about impending occurrence of drought.

This cannot be done if there is no permanent and efficient institutional framework. Therefore, it is strongly recommended to establish a Rangeland Monitoring Center.

The Monitoring Center would have to cope with the following main tasks:

- collecting and processing of data and documentation
- setting up a permanent field network of monitoring sites
- inventory present resources, establish monitoring procedures and implement them
- identify priority areas of intervention
- develop the guidelines for proper management
- follow up the effects of management measures
- identify specific fields for research and investigation
- liaise with other concerned institutions.

The monitoring sites established by RMR/SRS could be used providing they are permanently marked in the same way the JESS team has marked its ground permanent plots. Monitoring the aerial photo plots could prove very useful providing they can be relocated during subsequent aerial photo surveys. This might prove to be very difficult. The location of the RMR monitoring sites, the JESS ground permanent plots and the aerial photo plots in the Study Area are shown on Map 14 of the Atlas. It will be noted that most of the sites are located within the riverine area. The network should be more dense in the non-riverine areas than it is at present, although difficult access may be a major problem if the installation of ground plots is contemplated.

Presently the agro-meteorological data available for the Juba Valley area is totally insufficient to be of any use in linking it to biomass production. It would be unrealistic to set up a comprehensive network of agro-meteorological stations but it should not be too difficult to install a dense enough network of rain gauges. The procedures for the training of the staff as well as for the collection and transmission of data should be the same as those used by the Flood Early Warning Department of the Ministry of Agriculture.

Range analysis should emphasize range-condition classification over measurement of forage production and estimation of stocking rates and carrying capacity. Surveys should not be limited to vegetation and land use aspects: they will have to include a detailed analysis and monitoring of size, composition and seasonal movement patterns of livestock. This could be of paramount importance taking into account that the Bardheere dam will lead not only to a reduction of riverine rangelands, but also force modification of access to river water. Moreover, although it is expected that tsetse eradication will have but small effect on riverine livestock population growth, there could be some changes in the seasonal patterns of use of the riverine rangelands with an increase in rainy season grazing pressure.

A number of important long-term planning issues may be addressed once accurate carrying capacity and forage production data are available, including the balance between dry season and wet season feed resources, and the effects of agricultural development and changes in rangeland condition on future range resources and carrying capacities. These studies may then be combined with observations on crop residue and by-product production in different farming systems to make more informed predictions of agricultural development.

As far as field activities are concerned, care should be taken not simply to duplicate the former Northern Rangeland Development Project or the present CRDP by creating the equivalent of what could be called the "Southern Range Lands Development Project". However, there is valuable information to be drawn from the experience gained by these projects.

The present approach to range management, as demonstrated by the CRDP, is to systematically inventory range resources, organize local range and livestock associations based on traditional grazing and governing bodies, develop range management plans and, where needed, implement simple management interventions with the agreement of the Range and Livestock Association concerned.

Experience gained by the CRDP to date has shown that the successful completion of the Project's objectives will be slow and necessarily based on careful ground work, programme development, training, surveys, dialogue with the pastoralists, planning and subsequent continuation of NRA/pastoralist dialogues/cooperation through district staff and RLA committees.

One of the main limitations for range development, aside from the lack of basic data, is the severe shortage of adequately trained and qualified staff. At present it would be difficult to provide new sectors with adequate counterparts. Therefore, the formal education programme, including both university and technical components, must be strengthened so that sufficient numbers of qualified range managers become available.

ANNEX 8 / APPENDIX

Major Forestry and Range Projects

Major Forestry and Range Projects

Forestry Projects

Most forestry development initiatives in Somalia are donor-funded programmes coordinated through the NRA. Some of the most important forestry projects are briefly described herewith.

- "Central Range Lands Development Project - Forestry Component"
  Funding : GTZ
  Value : DM 6,842,000
  Start : 1983
  Objectives: to prevent further desertification around regional cities in the Central Range Lands (Beletweyne, Dusa Mareb, Galkayo)
  Activities:
    - to establish central nurseries for the production of plants and trees appropriate for afforestation
    - to plant and protect green belts around the three cities
    - to train Somali staff on the spot and abroad so they can continue to work independently from external assistance.

- "Afforestation for Refugee Settlements and Village Communities in Northwest Somalia"
  Funding : GTZ
  Value : DM 4,988,600
  Start : 1987
  Objectives: to stop the growing desertification around some refugee camps and villages in Northwest Somalia
  Activities:
    - assistance to the NRA within the scope of the project in the Northwestern Region in the following fields:
      . forestry planning and organization
      . transport and vehicle maintenance, and
      . extension or establishment of tree nurseries
    - rearing of forestry plants
    - afforestation of degraded areas, with particular emphasis on the refugee camps
    - promotion of community forestry and agro-forestry
    - analysis of consumption of firewood, identification of potential firewood savings and, where possible, effecting of such savings.

- "Forestry Sector Support and Training" (FAO)
  Funding : UNDP
  Value : US$ 1,100,000
  Start : 1988
  Duration : three years
  Objectives:
    - to train and assist National Range Agency personnel at Head Office in Mogadishu and in the regional offices of the Middle and Lower Juba Regions in forestry extension and forestry and wildlife management
    - to provide related extension services to rural communities

- to assist in development policies and related legislation designed to provide for the optimum management of forest resources of Somalia
- to identify and formulate new forestry and wildlife related projects
- to prepare a National Forestry Action Plan.

- "Land Use Survey for Land Use Planning" (FAO)
  Funding : UNDP
  Value : US$ 1,850,000
  Start : 1988
  Duration : three years
  Objectives:
  - to create a national capability for land resources survey and land use planning within the Land and Water Department of the Ministry of Agriculture
  - to carry out reconnaissance land resource survey and prepare land use plans in selected regions and sub-regions
  - to develop and standardize the methodology for land resource survey, land suitability evaluation and land use planning in the country
  - to initiate a land resource data bank which can later be extended to cover the whole of Somalia
  - to promote the awareness of the principle of correct land use planning.

- "Forestry Development and Strengthening of the Forestry Department" (FAO)
  Funding : FINNIDA
  Value : US$ 3,380,000
  Start : 1988
  Duration : four years
  Objectives:
  - to intensify extension and demonstration efforts through training and strengthening of the Somalia Institute of Forestry, Range and Wildlife Management especially with respect to community forestry
  - to implement a forestry inventory of the Lower Shebelli Region
  - to establish a forestry management plan for this region
  - to establish a forest extension service and demonstration areas and organize and execute country forestry projects in the region
  - to establish a model forest nursery at Afgoi and to develop village and school forest nurseries.

- "Tropical Forestry Action Plan for Somalia" (FAO)
  Funding : UNDP
  Value : US$ 137,000
  Start : 1988
  Duration : one year
  Objectives:
  - to analyze both qualitatively and quantitatively the past, current and potential of the forestry sector at the national level for social and economic development

- to determine and analyze the constraints in the forestry sector and the measures for reducing them
- to provide a coordinated short- to medium-term programme of action (over a five-year period), in harmony with national development priorities, based on the mission's proposals for attracting international technical assistance and financial investment in the fields of forestry and wildlife
- to make recommendations regarding strategies, legislation, institutional measures and policies which will form the basic elements for a long-term Forestry Sector Plan
- to provide support for the organization of a national seminar/round-table conference where the potential donors and government agencies are invited, to discuss the results of the above-mentioned actions.

- "British Forestry Project Somalia"
  Funding : ODA (Overseas Development Agency)
  Value : 2nd phase - £ 619,000
  Start : 1983 (1st phase), 1987 (2nd phase)
  Duration : two years (2nd phase)
  Objectives:
    - practical training of forestry, range and wildlife technicians which will enable them to carry out a wide range of forestry, range and wildlife related tasks, including extension work
    - to set up a data base and information center on Somali forestry activities
    - to establish species and management trials to determine the appropriate choice of indigenous and exotic species and their management
    - to make an assessment of afforestation projects at refugee camps
    - to make an inventory the major charcoal areas in the Bay Re- gion as well as the natural woodlands in these defined areas
    - to recommend possible methods of multipurpose management and define the intensity of exploitation in the woodlands which is acceptable.

Range Projects

- "Survey of Northern Range Lands Projects (1970 - 1972)"

  Although originally intended to inventory range and livestock resources in two northern regions, this project was early on required by the Government to include a "development" component.

  Ecological surveys, including the establishment of fenced inclosures to monitor vegetation changes under protection, and range and livestock surveys were carried out. However, the former were apparently not immediately applicable to range development and the latter were restricted by a lack of trained counterpart staff and poor access to livestock populations.

17 range reserves were established to improve vigor and productivity of rangelands and provide dry-season grazing. The results were varied. It was found that range reserves should not be managed as isolated units and without reference to traditional grazing areas. There was also a need to implement legislation controlling stock water development. Trial plantings of forage species were carried out, varieties of Cactus near Mogadishu and Atriplex at Las Anod.

It was noticed that there was a natural trend for pastoralists to settle, begin farming and enclose land for private use as well as to establish private water supplies.

Overall, the biggest problem was the lack of trained staff and the poor administrative infrastructure. From this ultimately came the push for the formation of the National Range Agency.

The biggest failures were:

- the inability to gather adequate baseline data about the range and livestock resources, and

- the diversion of limited development resources of this and following projects into "immediate development" activities that, ultimately failed due to hastiness, poor planning and a basic ignorance of the rangeland system being developed.

- "Rangeland Conservation and Development Project (1970 - 1972)"

This project stressed:

- the development of fodder production units where flood irrigation was used to increase fodder production

- field trials of introduced fodder species

- increasing quality and area of grazing reserves, and

- beginning a formal education programme for technicians at Burao.

Although some useful experience was gained from fodder production trials, the Fodder Production Units (FPUs) were found to be of dubious economic value because of the need to build earth structures (dams, bunds) to compensate for a lack of rainfall and runoff data.

It was also discovered that simple protection of degraded rangelands usually resulted in fast recovery of the vegetation and an entirely adequate forage production at a much lower cost.

Ranching cooperatives were introduced as a means to carry out range development and to investigate needed reforms in land tenure. The major problem here was that cooperatives were oversized, occupied the best land and could continue to use adjacent communal land while excluding outsiders from cooperative lands.

Grazing reserves were also retained but were extended to include (with cooperatives) all communal land and organized to have rotational grazing systems with 25% of the area being rested at any one time.

Pastoralists were apparently so eager to settle and obtain more secure rights to the land that they were very cooperative in helping establish both cooperative ranches and grazing reserves.

Unfortunately, this project ended prematurely because of a UNDP financial crisis.

- "Northern Range Lands Development Project (1977 - 1985)"

  The objectives of this project were to:

  - stop rangeland deterioration
  - continue to form range reserves
  - continue to develop fodder production units
  - start non-formal education at all levels
  - expand the training programme at Burao
  - initiate veterinary and stock water services.

  A large number of reserves (about 34) were established. The idea of demonstration ranches was also introduced. Overall interest in Cooperative ranches (on the part of project personnel) was diminishing and that in Local Grazing Associations (RLAs) increasing. RLAs included local involvement in reserve management with somewhat fewer formal rights to the land compared to cooperatives.

  The results were generally poor because of a lack of technical, financial and extension support/follow-up once reserves were formed. This was caused by a serious lack of trained counterpart staff and the concentration of those that did exist on the Fodder Production Units. It was apparently thought that, once formed, reserves could continue on their own. This was a mistake.

  Leading from this came a recommendation that any further efforts should concentrate limited development resources on a few carefully chosen reserves where proper methods of integrated management could be demonstrated and research carried out. Thus arose a conflict between the necessity not to develop reserves in isolation from the rest of the district and the very apparent need to make the best use of limited manpower, finances etc.

  Despite the findings of the previous project that Fodder Production Units (FPU's) were of doubtful economic value compared with less expensive measures of forage production and the need to increase emphasis on rangeland rehabilitation, FPUs were the principal feature of the NRDP. Most of the project resources were concentrated on them because of a need to use the limited number of counterparts to meet at least one of the project's objectives and to honor the contractual agreement with the private contractor building the earth structure.

Finally, however, the Fodder Production Units were found to have been too poorly planned and hastily built. They should also have been preceded by development of adequate seed and plant materials for planting on the completed FPUs. The project then recommended that less effort be put into FPUs in the future and that those efforts should be more carefully carried out.

- "Central Range Lands Development Project (1980 -)"

The Central Range Lands Development Project evolved from the preceding Northern Rangelands Project. It:

- increased emphasis on non-formal education
- continued the trend in formal education to the point of developing a Department of Botany and Range Management at the Somali National University
- returned (finally) to recognizing the need for gathering baseline data, establishment of monitoring programmes and initiating research studies of rangeland ecosystem processes
- continued the trend to shore up infrastructure by providing expatriate Directors for major NRA departments and by building new national, regional and district office buildings
- required an inquiry into the proper approach for introducing range management interventions into Somali rangelands before further efforts were carried out
- stopped Fodder Production Units
- instigated soil and water conservation activities
- finally begin stock water development and veterinary activities
- included a forestry component.

The initial World Bank proposal included a sequence of technical range surveys, classification and monitoring activities beginning with a resource inventory which would include two aerial censuses of livestock (wet and dry season) and the presentation of basic physical, vegetation and human resources within the context of mapped land system units.

This was to be followed by a ground survey to verify the resource inventory, classify range conditions (including development of classification guidelines) and, in cooperation with Non-Formal Education Officers, determine areas suitable for reserves.

Following this, range-trend monitoring sites (284 of them) were to be set up and personnel trained to record data for them.

Throughout this period Non-Formal Education Officers were to establish contact with the pastoralists, determine traditional patterns and areas of land use and prepare the way for formation of grazing reserves and organization of the people at the local level to help maintain reserves.

The Louis Berger International (LBI) Inception Plan for the CRDP kept most of the original proposals but modified those dealing with range management, verification of the resource inventory and research and field investigations. Emphasis was shifted from sequential activities by different teams throughout the whole three-region CRDP area to integrating these into the duties of a single range ecologist/non-formal education team working within one priority district within each region. Responsibility for research was shifted to the University.

In their approach to range management the LBI team defined "reserves" very broadly leaving considerable room for flexibility in fitting the management approach to existing circumstances and future range potential. In this regard there were definite reservations about trying to limit the mobility of the pastoralists and emphasis was placed on control of livestock distribution rather than numbers. Stock water development and soil and water conservation activities were to be included in range management plans where needed. Veterinary activities (not a LBI responsibility) were to be primarily of a survey nature.

A reserve was generally considered to coincide with a traditional grazing area of a particular group of pastoralists. A Range and Livestock Association (RLA), including all pastoralists traditionally using this area, was to be organized by Non-Formal Education Officers. The RLA, through its elected committee, would assist the Range Ecologist in preparing a management plan for the reserve and then assist the NRA district staff in carrying out the relevant management activities. Permanent sample plots for monitoring range trend were to be established by the Range Ecologist in each reserve.

Experience gained by the CRDP to date has shown that the successful completion of the Project's objectives will be slow and necessarily based on careful ground work, programme development, training, surveys, dialogue with the pastoralists, planning and subsequent continuation of NRA/pastoralist dialogues/cooperation through district staff and RLA committees.

In a more technical paper it was stated that range-condition classification is of more immediate value than the estimation of proper stocking rates/carrying capacities through sampling of forage production.

ANNEX 9

S O M A L I A

Masterplan for Juba Valley Development

Fisheries

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Fisheries

1. The Environment

To assess fishery conditions and potential, it is of primary importance to review first the environmental conditions of the aquatic habitat and interacting mechanisms.

The main features of the valley are the Juba River and adjacent low-lying flood plain areas which seasonally become inundated by river water, rain and runoff from other areas.

Of importance to fishery is the bimodal flow pattern of the Juba River: short and pronounced flood peaks occur during April and May, and more extreme peaks in length and magnitude in October to November.

From December to March/April, river discharges may fall below 5 m^3/sec to totally zero, resulting in a tremendous mass mortality of river fish as was the case for example in March 1987.

Of importance to assess other aspects of fisheries are the data on average annual rainfall, being about 700 mm near Jilib and in the more northern area of the valley being below 400 mm.

Mean air temperature rises slightly from south to north by 27.6°C at Jilib to 28.9°C at Bardheere, with the differences between mean maximum and mean minimum diurnal temperatures in the range from 12°C to 13°C. Relative humidity is highest at the coastal belt (73%) declining to 56% north of Bardheere.

According to MEREDITH [113, 114], the 800 km stretch of the Juba River within the territory of Somalia can be divided into two geographical regions, of importance to fisheries. The northern one, which extends from the border near Dolo to Saakow, is mainly dominated by the river. Only the southern one, which covers the section from Saakow to Kismayo, exhibits typical features of a floodplain which in the case of the Juba is submerged at least every second year when bankful discharge of the river is exceeded.

This part of the Juba Valley, being of particular interest to fisheries, is of the savannah type, flanked by a well developed and vast floodplain. The well defined river channel at each bend is deeper at the concave bank, where the current is fastest, whereas the convex banks have sandy or muddy point bars. During the high waters these features become submerged. Floating and emerging vegetation which tend to develop in the potamon is only scarcely developed.

The plain contains many types of water bodies, with the most distinct one being the desheks, defined as natural depressions which are seasonally flooded by river water and to some extent by rain and runoff from the adjacent marine plain. They may, in addition, be fed by groundwater.

Desheks may be permanent water bodies in that they persist from one flood phase to the next. Desheks of the temporary type, however, would dry out progressively as the low water phase advances.

Desheks of the latter type are traditionally used for crop production (deshek cultivation with receding water levels), whereas in permanent desheks, agricultural activities are confined to the peripheral areas.

Other features of the plain are pools of varying extensions and depths. They develop in simple depressions which receive flood water spilling over the levees.

Desheks, pools and pool-like swampy areas may permanently or temporarily join each other by a network of channels and creeks which at the occasion of heavy rains penetrates the levee thus directly flooding vast areas of the plain.

According to own calculations, the total floodplain area of the Juba covers roughly 3,750 km^2. This is presented in Table 1/1.

Table 1/1 Area of Floodplains per District

Districts	Floodplain area (km^2)	Floodplain area % of total	Semipermanent/ permanent swamps (km^2)	Semipermanent/ permanent swamps % of total	Desheks (km^2)
Bardheere	1,030	28.0	-	-	
Saakow	595	15.8	-	-	
Bu'aale	505	13.5	-	-	
Jilib	510	13.6	115	53.5	
Jamaame	1,020	27.2	-	-	
Afmadow	< 50	-	40.0	18.6	
Kismayo	90	2.4	60	27.9	
Total	3,750	100	215	100	127

The lack of detailed data does not allow to estimate a more accurate extension of water bodies where fish could thrive temporarily or permanently. However, it has been estimated from the above data that the potential area of fishing grounds in the Juba floodplain is close to 1,400 km^2.

2. Limnology

The sequence of inundation and dry phases due to the river bimodal nature results in the development of specific limnologic characteristics of floodplains and makes them outstanding among aquatic systems.

The plain contains many types of water bodies. Some of them hold water throughout the inter-flood periods. Because of silt deposition these bodies show a sequence from open lagoon through vegetation-lined pools and vegetated swamps to dry land. Thus old water bodies may disappear and new ones come into existence. During flood season water invades the plain and as this happens, organic and inorganic matter lying on the plain enter the solution. As a result the conductivity increases and dissolved oxygen concentrations decrease in the newly submerged areas, but as the flood persists the conductivity falls and dissolved oxygen concentrations rise again. During the dry season the oxygen content of the water in pools may come close to zero. At the same time the water volume shrinks due to evaporation followed by both temperature and conductivity increases.

The Juba, however, remains relatively cool and well oxygenated, provided that a constant flow above a certain level is assured. Otherwise the river breaks down into a chain of pools whose behavior is similar to that of the floodplain pools.

As in other floodplains of the savannah type, primary production of the Juba Valley is located in floating or emerging macrophytes. By far the most luxuriant aquatic vegetation was observed in shallow water bodies of the pool and swamp types, whereas desheks were almost free of vegetation with the exception of perennial types having flanks with Phragmites and Cyperus. Nymphaea and Pistia were abundant. These develop dense sheets on the surface of shallow pools near Jilib and further downstream. Submerged vegetation has not been detected.

Associated with the abundant Nympaea and Pistia vegetation were varied invertebrate fauna mainly composed of pulmonant snails which are widely used as bait by handline fisherman.

The submersed root masses, stems and leaves of the higher vegetation are covered with a complex plant and animal association. By contrast, bottom-living organisms remain scarce in the river as well as on the plain.

In addition, electrical conductivity and the total amount of dissolved solids (TDS) are limnologic components upon which an assessment of the fish productivity of floodplains can be based.

The EC_{25} data obtained for the Juba River so far includes values ranging from 100 (August 1977) to 4,700 (May 1980), the latter being the peak for the period 1978-1984. The average EC_{25} is estimated to be close to 700.

Salinity crests which generally last less than twenty hours coincide with the start of both the Gu and Der runoff seasons when salts are washed out which had accumulated on surface layers of the catchment areas during the preceding dry seasons.

High salinity are due to the presence of chlorides. Outside the rainy seasons, i.e. when the salinity is generally low, bicarbonate becomes the predominant ion. During low-water periods and when saline crests occur, sodium is the predominant cation. It will be replaced by calcium and magnesium during periods with low salinity.

Only few TDS measurements are available, published by ICA, 1961, as was quoted by USBR [82].

These data indicate that TDS values vary during the recording period of the months of March to July 1960. Maximum values between 1,065 and 1,414 mg/l were obtained during March and April. In the course of May, TDS dropped to 390 mg/l. The mean annual average is said to be close to 700 mg/l.

3. The Fishes

A list of species has been established by Meredith [113, 114]. This list is based on the assumption that the system is likely to be populated by fish known to occur in similar African rivers. During field surveys, he discovered 15 general species, two of which are not mentioned in his list (see Table 3/1).

Masterplan field reconnaissance revealed that the species indicated in Table 3/1 were either identified at fishing sites, found in markets or were reported by fishermen to occur in their catches.

Table 3/1 Fish Species in the Study Area

Family	Genus	Species
ANGUILLIDAE	Anguilla	A. annectens
ARIIDAE	Arius	A. brunellii
		A. gigas
		A. heudeloti
		A. latiscutatus
BAGRIDAE	Bagrus o	B. urostigma xo
		B. bayed macropterus
		B. docmoc niger
	Pardiglanis	P. tarabinii
	Clarotis x	C. laticeps x
		C. bidorsalis
CHANIDAE	Chanos	C. chanos
CHARACIDAE	Alestes	A. affinis xo
	Micralestes	M. acutidens
CICHLIDAE	Oreochromis	O. niloticus xo
		O. mossambicus
CLARIIDAE	Clarias xo	C. gariepinus xo
		C. lazera
		C. anguillaris
		C. submarginatus
	Heterobranchus o	H. bidorsalis
		H. longifilis
CYPRINIDAE	Labeo xo	L. bottegi
		L. cylindricus
		L. mesops
		L. ruddi
	Barbus xo	B. gananensis
		B. intermedius
		B. trimaculatus
		B. zanzibaricus
	Varicorhinus	V. sp. nov.
	Neobola	N. bottegi

Table 3/1 (cont.) Fish Species in the Study Area

Family	Genus	Species
CYPRINODONTIDAE	Nothobranchius	N. cyaneus
		N. jubbi
		N. microlepis
		N. patrizii
GOBIIDAE	Glossogogius	G. giurus xo
	Gobius xo	G. aenofuscus
		G. gymnopomus
LEPIDOSIRENIDAE	Protopterus	P. annectens
MALAPTERUIDAE	Malapterurus	M. electricus
MOCHOCIDAE	Synodontis xo	S. schall xo
		S. zambesensis
		S. serratus
		S. geledensis
	Hemisynodontis	H. membranaceus
	Brachysynodontis	B. batensoda
	Chiloglanis	C. modjensis
		C. brecibarbis
	Mochocus	M. niloticus
MORMYRIDAE	Mormyrops	M. deliciosus o
	Petrocephalus	P. catostoma
	Mormyrus	M. kannume
SCHILBEIDAE	Eutropius xo	E. depressirostris xo
	Schilbe	S. mystus o
	Physalia	P. somalensis

Source: [81]

x - from source in fieldwork
o - own identification during field investigation
no annotation - from source on literature basis.

Remark: Not included in MEREDITH's list are: Lates niloticus and Eleotris spp. but mentioned in MEREDITH (1987 a op.cit. and 1987 b op.cit.).

Data on the distribution pattern of Juba species are not available. The composition of catches from both the river and the floodplain pools permit concluding that an active migration of fish between the river channel and the floodplain takes place. Migrations are often for breeding but are equally important for feeding. Movements may be associated with avoidance of unfavourable conditions such as decrease of oxygen or overcrowding.

Migrations may be longitudinal within the river channel or lateral from the latter onto the floodplain. The first one is typical for riverine fish such as Labeo which show few adaptations other than a capacity for fast and sustained swimming. Species migrating laterally are adapted to lacustrine conditions resisting low oxygen contents and high temperatures. Their broad ecological adaptability arises from auxiliary respiratory organs capable of using atmospheric oxygen. These organs are, for example, present in species of the genus Clarias which is widespread in the area.

Migration and breeding are closely related. Gonads begin to mature towards the end of the low-water season and as the river rises and bankful conditions are attained ripe fish move laterally onto newly inundated areas where spawning would commence. Breeding success is probably enhanced on the floodplain by shelter provided for larval and juvenile fish in the form of grassy vegetation.

During the field survey, confirmation was obtained that spawning is associated with peak flow conditions. Fishermen at the Fanoole barrage described how during the onset of the Gu season, gravid fish are caught in the creeks and channels leading from the river to the floodplain. The specimen described resembled members of the genera Clarias, Heterobranchus, Bagrus, Eutropius, and Labeo. Evidence of the local breeding seasons was obtained through investigation into the developmental stage of gonads of fish shown by fishermen. For both, three adult Labeo (total mean length: 102 cm), and two Bagrus (total mean length: 102 cm), the stage of gonadal development was about 2 to 3, i.e. the fish may be expected to start spawning at the onset of the forthcoming Gu season.

4. The Fishermen

Three categories of fishermen were noted in the Juba River Valley:

- occasional fishermen
- part-time fishermen and
- professional (full-time) fishermen.

Almost all of the fishermen fall into the category of occasional and part-time fishermen because they indicated that agriculture was their main activity; they go out for fishing only when fish concentrate in pools and swamps and thus can easily be collected.

Interviews did not permit definite conclusions because replies of contacted persons were only rarely free of inconsistency. Therefore, assessment activities were concentrated on an evaluation of the household census carried out by JESS. From this census it was possible to depict the number of households having any type of fishing gear as well as the types of fishing gear owned. This is presented in Table 4/1 showing that the total number of households with fishing gear is to be 16,400, i.e. roughly 40% of the total number of households (41,472) are somehow engaged in fishing. Again 5,000 or about one-third of the households with fishing gear have more than one set of gear, which would refer to at least a part-time fisherman's household.

Table 4/1 Households with Fishing Gear

Districts	Kismayo	Jamaame	Jilib	Bu'aale	Saakow	Bardheere(3)	Total
1.H'hold sample	37	72	58	36	60	N/A	263
2.H'holds /district	2,073	15,018	1,645	5,291	2,345	N/A	41,472
Ratio (1)/(2) in %	1.8	0.5	0.35	0.7	2.6	N/A	0.6
3.Households with fishing gear	11	27	28	16	22	N/A	104
Ratio (3)/(1)	30	38	48	44	37	N/A	39
Households questioned with more than 1 set of fishing gear	6	4	8	4	10	N/A	32

Source: JESS Baseline Survey 1987 [81]

1) Derived from total number of district inhabitants divided by 5.5 persons for a household.
2) The term "fishing gear" refers to: hand lines, gill nets, traps, craft and others not specified.
3) Data not available at time of study.

The census included households having one or more gill nets. This gear usually would indicate a full-time fisherman rather than a part-time occupation.

The majority of gill nets observed during the field survey, however, proved to be in bad condition, thus not allowing for the conclusion that gill net owning households are those of full-time fishermen.

Thus, nearly all fishing on the river and the adjacent floodplain is carried out either occasionally or on a part-time basis. There would be hardly more than 50 professionals in the area.

5. Fishing Methods

Handlines are by far the most widespread gear in the river valley. Lines (monofilament nylon) and hooks (varying sizes) are available locally at prices varying from 100 to 300 SoSh according to the length of the line. Hooks are commonly baited with pieces of pulmonant snails. At river sites, live Labeo are fixed to the hooks as bait for larger catfish.

Widely used are lines to which more than one hook is attached. The lines are cast into the river and pulled jerkily hoping that the hooks may hit fish. This "jerking" technique is employed mainly where fish are expected to concentrate.

Longlines were seen only once. Fishermen appear to refuse their application because hooked fish are within easy reach of crocodiles and piscivorous turtles both of which are abundant in the Juba.

Traps are reportedly set, but none were shown during the field survey.

Fish spears seem to be quite common in the districts of Jamaame and Bu'aale where they are employed in deshek fishing together with "jerked" handlines.

Gill nets were reported to be favored in the Kismayo district. Since the webbings of gill nets have rather large meshes, gill netting is mainly directed towards the capture of larger fish. Gill netting is generally considered to be best during the hours of darkness; the gear is set during the evening and lifted in the morning. Gill nets shown during the field survey were commonly twenty meters long and two and a half meters deep. The webbing was made of multifilament cotton. The costs for webbing (cotton), floating and bottom lines were said to have increased from 1,500 SoSh to recently 8,000 Sosh as yarn is becoming more and more scarce in local markets.

Apart from the aforementioned gear types, gear was seen being operated which consisted of a single piece of webbing to which sinkers were attached. This gear is fixed to a long rope which is held by the fisherman who casts the net into the water, hoping that fish may get entangled in the meshes.

Only a very limited number of fishermen own boats (dugouts).

Table 5/1 shows the number and types of gear owned by all households of the valley. Figures permit the following tentative conclusions: hand lines and spears are most popular in the northern part of the valley; as one moves downstream, the fishing gear becomes more sophisticated as is suggested by the increase of the number of gill nets (to which a much higher catch gradient is attributed).

Table 5/1 Type and Number of Fishing Gear per Household

District	Number of fishing gear: Type — Hand lines	Gill nets	Traps	Spears
Kismayo	925	784	168	392
Jamaame	1,043	-	-	6,049
Jilib	8,149	577	289	2,310
Bu'aale	882	147	-	2,058
Saakow	430	78	195	704
Bardheere	N/A	N/A	N/A	N/A
Total	11,456	1,568	652	11,513

Source: JESS Baseline Survey 1987 [81]

6. Fish Processing and Marketing

Most of the catch is sold fresh. Only surplus catches arrive at markets as dried fish, the share of which is said to increase when the harvest of deshek fish is about to approach its peak.

Fish selected for drying are usually gutted, scaled (if necessary) and washed before being hung on branches of trees or spread out on simple racks being built close to fishing sites.

Fish below thirty centimeters in length are usually dried whole (Labeo). Larger specimens (Clarias, Bagrus, Heterobranchus) are split open into several stripes which remain attached to the head. Fishermen claim that smaller fish would become dry within three to four days, whilst larger ones would require ten to fourteen days. The dry weight of the processed product is about one-third of the fresh weight.

Somali Marine Products, in Kismayo, is reported to have accepted, on occasion, fish from valley fishermen for deep freezing, anticipating that the fish market at Mogadishu would readily accept the product. However, both the irregular supply of raw fish and the unclear demand in Mogadishu were discouraging, resulting in the decision to exclude fresh water fish as long as continuous supply remains doubtful and marketing problems exist.

No indications are thus far evident which would point to the establishment of a fish distribution and marketing system in the river valley. This may be attributed to infrastructural shortcomings and the subsistence character of fisheries.

Retailing of fish remains primarily in the hands of fishermen who would sell the catch either close to fishing grounds or at the door of their houses. Only the surplus is taken to local markets for which the supply is entirely left to chance.

The current price of freshwater fish ranges from 40 SoSh/kg of Labeo to 80 SoSh/kg for larger catfish specimens. The prices for meat vary between 120 and 200 SoSh/kg. Dried Clarias prices are 10 to 20% above those prices for fresh fish.

7. Fish Consumption

Fish consumption contributes to human needs for animal protein. The daily protein requirement for an individual man amounts to roughly 1 g per kg of body weight. As is generally agreed, 0.5 g should be of animal origin. Taking into account an average body weight of 70 kg, the annual animal protein demand per person would be 12.8 kg.

The aforementioned yield potential of 2,000 tons/year refers to the raw fish weight, the edible part of which constitutes about 80% containing some 25% protein. Hence it follows that the potential would be good for 400 tons of animal protein which would conform to the annual demand of 31,250 persons representing about 9% of the sedentary population at present living in the Study Area.

The amount of consumed fresh fish in the Juba Valley is not far behind that for goat meat, particularly in Jilaal, since low water levels in the river make fishing more easy. In addition, people tend to have more time for fishing during the dry season and there are often fewer other food sources around.

Fresh fish is consumed far more than is dried fish. Most often fish is consumed by urban households, followed by households practicing riverine agriculture. Non-riverine agriculturalists hardly consume fish, while nomads nearly never do (JESS, SEBS). The minimal consumption of fish by nomadic groups is explained by unfamiliarity with fish and fishing. Although there is not a formal taboo on fish consumption, people of nomadic background tend to avoid fish consumption even after they have settled for several generations. It is usually only under conditions of environmental or economic stress that they learn about and begin to consume fish.

Fish consumption in Mogadishu was very low on a per capita basis until the Government launched a programme in the late 1970s.

8. Assessment of Fish Yield Potential

Because of the lack of accurate data, MEREDITH [113, 114] suggested to base a first estimate on the following formulae proposed by WELCOMME (1985) [132] for African floodplain systems:

- formula (i): $C = 0.030\ A^{0.97}$
- formula (ii): $C = 0.023\ L^{1.98}$

where C is the annual catch (tons), A is the basin area (km^2) and L is the length of the river (km).

In the case of the Juba River, A would be 76,000 km^2 (representing the basin area within Somalia territory) and L is 800 km (corresponding to the river length within aforementioned territory).

By applying these formulae, the catch potential would be 1,600 tons/year according to formula (i) and 1,800 tons/year according to formula (ii).

An additional catch assessment was made by BARSLEY (1983) [103] who presumes an annual yield of about 2,300 tons. This appraisal appears to be in the close neighbourhood with WORLD CONCERNS's catch prediction of 2,400 tons, as quoted by MEREDITH [113, 114].

These yield predictions point to a potential of the Juba Valley fisheries of about 2,000 tons per year. Relating this yield potential to the total area of the river valley covering about 3,500 km^2, the annual yield would be around 50 kg/ha.

Improved yield estimates would require more precise catch data, number of fishermen and catch per unit effort data, etc. The formulae should be used with caution, to provide initial estimates only. These figures refer to fish production potentials. Actual fishing, as was frequently reported and could be observed in the field, is far below the identified potential.

Based on an average price of 60 SoSh/kg, the potential annual fish yield from Juba River would represent a value of 120 million SoSh.

It is expected that the reservoir will contain a rich fish resource after filling. African reservoirs undergo an explosive boom of fish populations during initial stages while inundated vegetations decomposes and releases nurtients into the water. Before nutrients stabilize and the reservoir matures, fish populations will develop at spectaculare rates, until nutrients wane and fish predator populations increase. Within a decade, potential fish predator populations increase. Within a decade, potential fish catches will decline and come into balance with a slower rate of nutrient inputs. Even after the reservoir attains maturity, fish populations will still remain a significant resource.

9. Improvement of Conditions for Fisheries

The Juba represents at present a limited fishery potential, with most of the fish actually being caught in the desheks. Apart from the approximate composition of the stock of fish, not much else is known and the Government has not developed any specific policy for freshwater fishery development.

In future, two major changes will occur as a result of the dam. One is the establishment of the reservoir representing a completely new ecosystem with its particular fishery potential. The other is the almost complete disappearance of deshek flooding. While the consequences of these changes can be globally assessed, considerable uncertainty exists with respect to the details of the likely future development of the fisheries sub-sector in the Juba Valley.

One potential so far not utilized is aquaculture, for which the irrigation canals of the large schemes provide a suitable base. This represents possibly the most significant potential and could lead to fisheries playing a more important role.

Fisheries thus does not play a major role at present in the economy of the Juba Valley. Nonetheless, a limited number of development proposals are presented, concerning establishment of a fisheries unit in the Juba Valley, setting up a management scheme for reservoir fishing and carrying out a pilot project for aquaculture in the Lower Juba.

(1) Establishment of Fisheries Unit in Juba Valley

Establishment of the dam will significantly alter the present situation with respect to fisheries. In the reservoir, a rapid increase of the fish population can be expected in the early years, as nutrients will be abundant. Thereafter, however, the number of fish will decline to an equilibrium which cannot be predicted at this time, because much depends on the limnological conditions in the reservoir after a settling period of several years. Downstream of the dam, conditions in the river will be much different as the flow will be steadier, the water quality with respect to chemical composition and physical properties different and flooding of desheks much less frequent and less intense.

To formulate appropriate policies for making best use of the potential under these changing conditions requires a reliable data base and studies including the following components:

- compiling an inventory of fish species
- investigating seasonal changes in fish population, structure and biomass and responses of the population to current exploitation modes
- studying feeding and reproductive patterns

- collecting information about the number and type of fishermen, kind and types of fishing gear used, extent of the catches, catch effort per unit, processing techniques, distribution and marketing of fish, consumption of fish and the role of fish in relation to the food requirements of the local population, and

- determining the attitude of fishermen towards the intensification of exploitation, relevant training and promotional aid.

A prerequisite for such activities is the establishment of a permanent field station of the Ministry of Fisheries in the area and the recruitment of a small number of scientists. This unit should then also serve as base for providing a limited extension service to those farmers fishing on a regular basis. Such extension has proven valuable in the Shebelli valley and is already being tried with good reseults in the Study Area. The most central location for this unit would initially be Jilib with the need for a second unit at Bardheere, once the dam is closed.

(2) Reservoir Fisheries Development

Based on the improved data bank and studies proposed above, a fisheries management scheme needs to be defined and implemented for the Bardheere reservoir. The objective of the scheme is to promote and organize the rational use of the fisheries potential in the reservoir. This requires also an analysis of the market prospects and the most appropriate organizational form the exploitation should take. The possibility for issuing fishing concessions to private national or international firms needs to be considered.

The direct beneficiaries of this programme will be those people involved in reservoir fishing. In addition, consumers will be benefitting from a larger supply of fish. To what extent fish could be exported would still have to be determined.

As mentioned, the management scheme will have to rely on the data and studies generated by the fisheries unit proposed above and is therefore linked to it. The most suitable location for the scheme would be Bardheere, with branches along the reservoir. For effective marketing of any reservoir fish, the reservoir needs to be connected to the national road grid by an all-weather road and to the national telephone system.

(3) Aquaculture

Fish husbandry is not practiced at present, despite the potential which exists for doing so. To assess and test the opportunities for aquaculture development, a pilot project is proposed which will

- test the feasibility of introducing available aquacultural technology from outside

- develop and test appropriate techniques for using irrigation structures (canals, reservoirs) for fish husbandry

- test the feasibility of fish ponds within irrigation schemes, taking into account land and water requirements of pond culture

- undertake in-depth studies to determine the most economical aquacultural practices under existing social conditions, and

- identify the need for aquacultural research and extension services.

Initially, the introduction of cage culture of fish will be considered, as this technique can easily be employed in existing irrigation structures without interfering with their operation and does not require any additional water. The main irrigation canal of the Fanoole Rice Project, close to the main road and the rice mill, would be a suitable location for starting such a pilot project. The species of fish most suitable for cage culture is probably Tilapia.

The beneficiaries of this pilot project, for which responsibility will be with the Ministry of Fisheries, will initially be the Government. Undertaking aquaculture then on a larger scale would directly benefit the operators of the large irrigation systems (SGUs 3 and 4), who could give fishing rights to the people working there. Indirectly, the consumers would benefit from an additional supply of fish.

ANNEX 10

S O M A L I A

Masterplan for Juba Valley Development

Industry

ANNEX 10

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Industry

1. Somalia's Industrial Sector

At independence, Somalia inherited a small industrial base. Even today, the contribution of manufacturing in the formal or official sector (defined as comprising all enterprises with five or more employees) does probably not add more than 5% to GDP. For the informal sector, including the people engaged in crafts and cottage industries, no data exist.

Initially, investments in industry were directed to exploiting agricultural resources, e.g. cotton and sugar, employing relatively simple technologies. From 1980 onwards, a number of technologically sophisticated projects were undertaken (refinery, urea plant), but these have performed poorly for a variety of reasons.

Employment, estimated roughly at 10,000 people in the formal sector originate for 80% from the public and to 20% from the private sector. Most larger manufacturing enterprises are Government owned, while the private sector mainly assembles or processes imported raw materials.

Geographically, industrial activities center around Mogadishu, but sizeable units are also located in the Juba valley.

Performance of the sector has been disappointing; this is best illustrated by the low average capacity utilization, which was estimated at 30 to 35% in 1986. For the private sector, the situation is not much better. As a result, financial performance has been poor and many enterprises are only kept alive by a variety of protection measures; these measures include levying of import duties on finished as well as intermediary products and by requiring firms to purchase outputs from each other to reduce imports. In economic terms, many enterprises are not viable.

There are several interrelated reasons for the poor performance of the industrial sector.

First, those industries depending for their raw material supply on local sources, e.g. cotton, sugar, rice, hides and skins, often suffer from low levels of supply. In such cases, the underlying problems are those of the agricultural sector, which, of course, suffer from a number of similar constraints as industry.

Second, there is a severe shortage of technical and managerial skills, which is aggravated by the fact that skilled manpower often migrates to the Gulf countries.

Third, foreign exchange is scarce, causing difficulties in providing industry with the necessary fuel, spare parts, raw materials and operating inputs.

Fourth, the domestic market potential is limited because of its small size and low levels of purchasing power, while export of industrial products hardly occurs.

Finally, the level of wages and salaries paid by public sector enterprises is very low and has resulted in low discipline and morale, and in high levels of absenteeism. The private sector also suffers from Government policies, but is more flexible to overcome this constraint.

The Government is generally aware of these problems and has defined policies and strategies to overcome them. These include the physical rehabilitation of public sector enterprises, greater autonomy to enterprises in setting prices of products and the level of wages and salaries, ensuring the availability of foreign exchange, promotion of local and foreign private investment and vocational and management training. These policies, when actually implemented, should provide an improved basis for a better performance of Somalia's industrial sector.

2. Industrial Development in the Juba Valley

2.1 The Formal Sector

Industrial activities in the formal sector in the Juba valley are carried out by seven public and one private sector firm. A ninth industrial unit, a cotton ginnery at Jamaame, operated until 1983.

The basic data for these eight enterprises are given in Table 2.1/1, highlighting a number of characteristics of the formal sector.

Ownership of the enterprises is predominantly public. Only one of the eight (INCAS) is majority controlled by private interests. The other (Juba Sugar) has minority foreign participation. It should be noted that the sugar and two rice mills are not necessarily enterprises by themselves but are part of larger, integrated projects.

All of the enterprises are located in the Lower Juba Region between Jilib and Kismayo. The location of the enterprises is largely determined by the location of certain crop production activities, and in the case of Kismayo in the relative better support services offered by this town.

With respect to the backward linkages (here: provision of raw material), seven of the eight enterprises obtain this raw material from the local crop production and the livestock sector. Only for INCAS, raw materials (kraft paper, polyethylene granules) are imported. Operating supplies, including maintenance materials, are practically all imported. Exceptions are locally produced salt, lime, oxygen, plastic bags (at three times the price of imports) and some services such as tyre retreading and precision mechanical engineering, the latter being provided in Mogadishu.

Concerning their markets, the three of seven different main products of the enterprises are exclusively for local consumption (sugar, rice, maize meal), in three other cases largely for export (processed meat, leather, fish) and in one case (packing material) for other local industries for export of bananas. The by-products are used as a source of energy (bagasse and rice husks), as animal feed (rice bran), as export (molasses) and for local consumption (first category animal by-products). The by-products wasted are surplus bagasse, which could be a raw material for the production of charcoal or animal feed, the rice husks of the Fanoole rice mill, which could be used for additional generation of energy at Mogambo or also for charcoal making, second category by-products of the meat factory and the waste of the fish factory, which could both form the base for high quality animal feed.

Production performance of the enterprises has certainly not been satisfactory, with INCAS and the sugar mill having the best capacity utilizations. The insufficient supply of raw materials is the primary constraint for the formal sector enterprises in the Juba valley. Most of the factories could process substantially more raw materials before they would be limited by the secondary constraints. Exceptions to this are INCAS and the meat factory, where the limited market opportunities are the bottlenecks.

If the primary constraints were overcome, the enterprises would then, at a higher level of capacity utilization, be limited by the shortage of locally available technical and managerial skills, and the lack of foreign exchange to adequately maintain, repair and replace the production facilities.

Table 2.1/1 Basic Data about Industrial Enterprises in the Formal Sector in the Juba Valley

Item	Juba Sugar Mill	INCAS	Fanoole Rice Mill	Mogambo Rice Mill	Kismayo Meat Factory	SLA Tannery	ADC Maize Mill	Somali Marine Products
Type of enterprise	Processing of sugar cane of Juba Sugar project	Manufacturing of plastic bags and cartons required as packaging material for export of bananas	Processing of paddy from Fanoole Rice Project	Processing of paddy from Mogambo Rice Project	Production of corned beef and beef stew	Processing of semi-finished and finished leather	Milling of maize	Processing and freezing of marine fish
Location	Marerre	Jamaame	Fanoole	Mogambo	Kismayo	Kismayo	Kismayo	Kismayo
Started production	1980	1971/74	1985	1988	1964	1977	1974	1982
Ownership	Mixed (Ministry of Commerce and Industry, United Molasses, IFC)	Private (100% subsidiary of SOMALFRUIT)	Public (Ministry of Agriculture)	Public (Ministry of Agriculture)	Public (Ministry of Commerce and Industry)	Public (Ministry of Commerce and Industry)	Public (Agriculture Development Corporation, Ministry of Agriculture)	Public (Ministry of Fisheries
Employment	600	180	50	50	230	80	10	60
Raw materials (origin)	Sugar cane (local)	Kraft paper, polyethylene granules (imported)	Paddy (local)	Paddy (local)	Cattle (local)	Hides and skins (local)	Maize (local)	Marine fish (local)
Operating inputs (origin)	Lime (local) Spares (own workshop, some services from private sector in Mogadishu, imports)	Corn starch, ink, spares (imports)	Spares (imports)	Spares (imports)	Salt (local) Cans (imports) Spares (imports)	Lime, Salt (local) Chemicals(imports)	Spares (imports)	Spares (imports)
Source of energy	Steam generation by bagasse fired boiler. Electricity generation by steam turbines	Steam generation by oil fired boiler. Electricity generation by diesel generators	Electricity from Fanoole hydro-power station	Steam generation by rice husks fired boiler. Electricity generation by steam turbines	Steam generation by oil fired boiler. Electricity generation by diesel generators and from municipal supply (new)	Electricity generation by diesel generators and from municipal supply (new)	Electricity generation by diesel generators and from municipal supply (new)	Electricity generation by diesel generators and from municipal supply (new)
Main product (Destination)	Sugar (local market)	Plastic bags, cartons (70-85% for packaging of banana exports, 15-30% local market)	Polished rice (local and institutions, military)	Polished rice (local market)	Canned corned beef (mostly for export)	Wet blue hides (export market) Finished leather (local market)	Maize meal (local market)	Frozen marine products (mostly for export)
By-products (Use)	Bagasse (source of energy but 2% dry fibre unused) Molasses(exported)	None	Rice husks(unused) Rice bran (animal feed)	Rice husks (source of energy) Rice bran (animal feed)	Liver, tripe, heart, kidney (local consumption). Hooves, horns, blood, paunch, tallow, bones, viscera (unused)	None	Hulls (animal feed)	Guts, etc. (unused)
Capacity	63,000 t/year of sugar	17,000 boxes/shift 2.7 t bags/shift	18,000 t/year white rice	12,000 t/year white rice	200 cattle/day 22 t/day processed meat	250 hides/shift	1 t/hour maize	20 t/day raw fish
Capacity utilization in recent past	45 - 67%	70 - 80%	<10%	Not yet commissioned	<10%	30%	30%	15%
Primary constraint	Insufficient raw material (sugar cane)	Limited domestic market	Insufficient raw material (paddy)	Not yet commissioned	Limited export market	Insufficient raw materials (hides). Skin processing equipment not operational	Insufficient raw materials (maize)	Insufficient raw materials (marine fish)
Secondary constraint	Insufficient foreign exchange for spares. Low level of local technical and managerial skills	None	Low level of local technical and managerial skills	Not yet commissioned	Much of equipment not any longer operational. Low level of local technical and managerial skills	Much of equipment not any longer operational. Low level of local technical and managerial skills	None	Low level of local technical and managerial skills
Remarks	Factory managed by Booker Agriculture. Project is receiving only 30% of sugar retail price, which is far from satisfactory resulting in low wages and salaries and high turnover of personnel	All required imports are directly carried out by SOMALFRUIT. Plant assisted by two expatriates	Technical operation by Chinese experts (10). Great difficulties are encountered in attracting well qualified local staff to work at the mill. Moisture control of paddy relies on sun drying which is difficult	Assisted by German development aid. Expected date of commissioning of mill is February 1988	Originally established with assistance from and exports for UdSSR. After 1977 export market and production collapsed. Rehabilitation of corned beef line in 1986 through FAO and production of 200 t for UNHCR for Mozambique	Hides come to 80% from Mogadishu for processing. Some parts of factory need rehabilitation. Skin processing not any longer operational	Appeared to be a well looked after installation	Under management contract with German firm. Assisted by German development aid. Raw material supply supposed to be through fishing cooperatives, but too little

Source: Own investigations.

Total employment in the eight enterprises is only 1,260 people, which is small when compared to the original investment, roughly estimated to be more than US$ 150 million. At an investment of US$ 120,000 per job, it is quite clear that the main objective of these industries is not the generation of employment, but the efficient provision of essential processing services, employing capital intensive technologies.

2.2 The Informal Sector

The small scale enterprises, employing generally not more than five persons and using relatively more simple technologies, represent a wide variety of activities, which can best be grouped under three headings:

- manufacturing or processing enterprises using animal/engine- driven equipment
- manufacturing or processing enterprises using only hand tools and manual labour, including construction
- enterprises engaged in services, i.e. mainly repair.

2.2.1 Enterprises Using Engine-driven Equipment

The most prevalent enterprises under this category are the maize/sorghum and the sesame oil mills, of which about 50 and 25 respectively operate in the District Centers. In addition five coffee grinding mills and three tobacco manufacturing enterprises have established themselves in the Lower Juba Region.

While the technology is simple, it is fully mastered by the personnel operating the mills and by the local mechanics. The number of mills has been increasing during recent years, indicating that demand for these services is growing and that the small entrepreneurs are responding to the opportunities this market offers.

2.2.2 Enterprises Using Hand Tools

Blacksmiths operate in all District Centers and, in the South, also in some villages. Using scrap from old cars and trucks, they manufacture all traditionally required metal tools such as yambos, axes, knives and spears. Workmanship varies from excellent to poor.

Woodworking is done on a traditional level in most villages, making very basic items mainly for own use. In the Lower Juba Region, a number of carpenters have established themselves making furniture for the urban market, using imported wood.

Pottery is practiced in many of the villages along the Juba. Some, such as Bulogaras, just outside Bardheere, have specialized in this craft and sell their products in a number of markets.

Basket and mat weaving is practiced in all villages. In the Kismayo area, baskets are made for the tourist market in Mogadishu.

Leather work has a very long established tradition with the nomadic population. The hides of camels slaughtered by the nomads are practically all used for own consumption as carpets, tenting material, saddles, belts, water and milk containers, etc. The quality of work done in this is generally quite high.

In the District Centers, some artisans make sandals from leather and car tyres and tubes. Generally, the craftsmanship of this work is poor.

In Kismayo, a private shoe factory, employing about 20 people, makes various types of sandals and shoes. Except for some manually operated sewing machines, all work is done by hand, quality being mediocre.

South-west of Kismayo, a number of people have established wood fired furnaces along the beach to produce lime mainly used for construction activities.

Textile oriented activities are restricted to sewing, each District Center having from 5 to 30 sewing machine operators. Garment manufacturing takes place only to a very limited extent.

2.2.3 Service Establishments

Besides hotels, restaurants, tea shops and stores which are not considered here, the District Centers all have some, albeit limited workshop capacity for car repair and basic metal working.

In Jilib and Kismayo, a number of workshops have specialized in the repair of electrical, electronic and refrigeration equipment, including the rewinding of electric motors.

2.2.4 Characteristics of the Informal Sector

The privately owned enterprises of the informal sector have developed with the changing socioeconomic and technological conditions in the Juba Valley. They provide essential services to the community, and are largely based on locally available resources and skills and geared to satisfy the demand in their immediate vicinity. In the South, where the regional economy is relatively more advanced, the number and type of enterprises is more diversified, but with this the dependence on raw material supply from outside the region, here Mogadishu, increases. The level of technical skills is generally low and quality of products and services could be much improved.

For the technologically most complex equipment, i.e. the maize/sorghum and sesame oil mills, support services have developed locally as well as in Mogadishu. The existence of such services make the profitable operation of these mills possible.

A survey of crafts and trades done in 1984 in the towns of Bardheere, Bu'aale and Jilib concluded that the number of jobs created by enterprises in the informal sector is small, as the average number of employees was found to be less than two. The survey also found that by far the largest number of enterprises (70-90%) are engaged in trading and services and only the remainder in manufacturing or processing.

The number of enterprises is clearly increasing, except for Bu'aale, where future growth appears to be entirely dependent on overcoming the infrastructural isolation.

3. Potential and Constraints for Future Development

3.1 Natural Resources

The main natural resource base for industry will also in future be provided by crop and livestock production.

From crop production, the following crops require further processing before they can be consumed:

- maize, sorghum
- rice
- sugar cane
- oil seeds (sesame, groundnuts, sunflower, safflower)
- cotton.

For most of these crops, processing facilities already exist in the Juba valley. Except for sesame, the other oil seeds are not grown to any large extent in the past and have therefore not been processed. Cotton was ginned until 1983, but the ginnery at Jamaame is now not any longer operational.

Fruits and vegetables might in future be a source of further industrial activities, but results depend on assuring a reliable flow of good quality raw materials for a limited domestic market.

The livestock sector supplies meat, hides and skins, animal by-products and milk.

At present, industrial use is made to a large extent only of the hides and skins. The collection rate of 50% is low and the quality of flaying and curing is poor, resulting in low-grade leather.

From the other sectors, i.e. minerals, riverine fisheries, and forestry, the raw material supply is expected to be very small.

3.2 Markets

The analysis of the market potential for products originating in the Juba Valley, has shown, that there is considerable potential for import substitution with respect to maize, rice, edible oils, sugar and cotton. If these raw materials are produced by the agricultural sector, then additional industrial capacity, particularly with respect to sugar and edible oils processing will have to be built up.

On the livestock side, the potential markets were shown to be much more limited. The most promising product being leather, particularly for export. For processed meat, the market in Somalia itself is very small and the export market extremely competitive. There is a market for animal feed from crop and animal by-products, and there should be some potential for milk products.

With growing incomes, demand for industrial consumer and household goods will increase. More mechanized crop production will also augment the demand for more technological advanced implements. This demand will, however, be quite limited and most probably be satisfied by the industries in Mogadishu serving the total national market.

3.3 Human Resources

There is no large, readily available pool of labour which could be utilized as a base for large-scale labour-intensive industrial projects. The limited potential surplus labour projected for the future will most likely be fully utilized by the expected additional agricultural activities.

Apart from the quantity in labour supply, quality of labour is a considerable constraint, as the level of technical and managerial skills is generally low in the country, with a concentration of the existing skills in Mogadishu. This is a national, long-term problem, which will continue to hamper sectoral development in the near future.

3.4 Industrial Policy

Development of the industrial sector is affected by the policies the Government pursues. Probably the two most important policy areas in this context are the degree to which the private sector will be allowed to participate in industrial activities and the question of incentives, i.e. the setting of wages and salaries, and also the extent to which enterprises will be free to set their product prices. More liberal policies in both these areas will considerably help in making more efficient use of the limited resources of this sector.

Finally, industrial development is also substantially affected by the overall economic conditions and policies of the country, most notably the availability of and allocation mechanism for foreign exchange.

3.5 Conclusions

In overall economic terms, the industrial sector plays a minor role in both the country's economy as well as in the Juba valley. Nonetheless, industry makes an important contribution, as it processes many of the agricultural raw materials into consumable products. It also provides basic tools and implements, increases local value added to some of the country's exports, adds to the diversity of the regional economy and generates employment in the rural as well as the urban areas.

Further development of the formal industrial sector is most promising with respect to processing the additionally projected output from crop and livestock production, particularly for the substitution of imports. Some possibility exists for generating more foreign exchange through increased processing of hides and skins and, in the longer term, also of meat.

With incomes, albeit slowly growing, demand for consumer products and services will diversify and provide a basis for future growth in the industrial sector in Mogadishu, from where the more sophisticated products and services will be delivered for some time to come, and in the Juba valley, where there is considerable growth potential especially for the private and informal sector.

The most challenging task for the industrial sector will be to overcome the generally low level of technical and managerial skills, to compete with a limited number of products in the world market and to formulate industrial policies conducive to better use of the country's resources.

4. Impact of Bardheere Dam Project

The main effect of the Bardheere dam will be the increased and more reliable supply of water and electricity. For the industries in the Juba valley, water supply has only indirectly been a problem in so far as it has limited agricultural production of the required raw materials. In this respect, Bardheere dam will substantially help to increase agricultural production and thus provide a basis for better utilization of the existing and future industrial capacities.

A more reliable supply of electricity will have a considerable impact on industrial development. Exceptions to this are the energy self-sufficient industries of sugar and rice milling. In all other cases, where industries employ other than human or animal powered technologies, the reliable supply of electrical energy will support the development of industry in four possible ways.

First, the risk of energy shortages is considerably reduced, which should potentially allow a better utilization of capacities and thus higher profitability and, in turn, facilitate investment decisions.

Second, the cost of electricity can expected to be lower than the present one of diesel generation. Again, this should give better financial results and more favourable investment decisions.

Third, the possibility of having access to a reliable supply of electricity at low investment cost will facilitate the mechanization of small-scale enterprises, improving efficiency and quality of work.

Fourth and finally, the above effects are likely to lead to a more diversified industrial structure.

An interesting case study is Jilib, the only district center where electricity has been regularly available for the last three years. There, practically all diesel engines of the maize/sorghum and sesame oil mills have been replaced by electric motors, reducing costs, increasing availability and considerably improving the working environment (less noise and air pollution). Furthermore, the informal sector shows a considerably more diversified structure with respect to manufacturing and service enterprises, using more equipment than in other, comparable district centers.

5. Industrial Development

A concept for the industrial development in the Juba valley has to take into account

- the national context, i.e. the nationally defined sectoral objectives, policies and strategies

- the present stage of industrial development in the Juba valley

- the future potential and constraints posed by the available human and natural resources, the market potential and the likely overall socio-economic development of the country.

The last two of the above aspects have been discussed in detail in the preceding chapters and will not be repeated here. The first, i.e. the national context, is discussed in the following before presenting the more specific development concept and project ideas for the industrial sector in the Juba valley.

5.1 National Objectives, Policies and Strategies

The objectives of the industrial sector have been defined in the National Development Strategy and Programme 1987-1989 prepared by the Ministry of National Planning [53] as follows:

- to accelerate the pace of industrial development and maximize production

- to replace imports of manufactured goods by local production wherever economically feasible

- to promote the export of manufactured goods and maximize value added by local processing

- to encourage the involvement of the private sector

- to encourage the establishment of labour-intensive and cottage-level industries.

To achieve these objectives, the same document also defines the required policies and strategies in the following manner:

- Public sector industries will be rehabilitated and efficiency increased by, inter alia, using management consultants, giving more autonomy to management and training of local staff. Financially, they will be autonomous, having discretion in the pricing of products and the setting of wages and salaries. The availability of local raw materials and foreign exchange for procuring the necessary inputs will be ensured. Marketing channels will be improved.

- Private sector investment by local and foreign entrepreneurs will be actively encouraged and protection provided.

- Credit will be made available to the public and private sector with preference being given to private small-scale enterprises.

- Indigenous raw materials will be used to the maximum extent possible.

- Labour-intensive techniques will be used where suitable labour is available. Vocational and technical training will be provided for labour and management.

- Regional diversification will be encouraged through preferential treatment for new industrial units in outlying areas, cottage industries and village-level enterprises.

The so defined national objectives, policies and strategies provide a rational framework for the development of the industrial sector as a whole thus also supporting the specific development in the Juba valley. They are ambitious policy statements requiring a considerable amount of initiative by the Government but, when actually implemented, should provide a sound basis for an improved performance of Somalia's industrial sector.

5.2 Industrial Development Concept for the Juba Valley

Combining the requirements of the national context with the present stage of industrial development in the Juba Valley and the potential and constraints prevailing there, two main tasks can be defined for industry. First, it is the processing of the raw materials provided by crop and livestock production. Second, it is to satisfy, as far as possible, local demand for industrial goods and services.

5.2.1 Processing of Raw Materials

Lacking a substantial resource base other than raw materials from crop and livestock production, it is the foremost task of industry to efficiently process these raw materials in such a manner that they can be consumed by the local population, used as inputs by industries outside the Juba valley or exported in order to obtain badly needed foreign exchange.

The emphasis of this foremost task of the industrial sector has to be on the efficiency of the transformation process. In order to be efficient, industry has to

- make the best possible use of existing production facilities

- utilize the available raw materials and by-products as economically as possible, thus maximizing value added

- make investment decisions for the rehabilitation or new establishment of larger industrial facilities in a national context

- be supported by Government policies conducive to increasing efficiency of industrial operations.

From this, specific project ideas can be derived.

First, the largest industrial units at present and in future will process the staple food items such as sugar, rice, maize/sorghum and edible oils. For these, the processing capacities are presently far in excess of raw material production, i.e. capacity expansion projects will only come up in the longer term. It should also be noted that it is only for sugar and rice essential to do the milling as close as possible to the location of production of the raw material, as transport costs for the raw material would otherwise be prohibitive. For other cereals and oil seeds the industrial facility could also be located elsewhere, if that would be overall more economic.

Of great importance is, however, that the existing capacities are properly operated and maintained so that full use is made of their potential. In the past this has not been the case, mainly because of a lack of foreign exchange, which might at some point in time make it necessary to undertake rehabilitation projects.

Some of the industrial units are already in need of such rehabilitation. This is quite obviously the case for the Somaltex Ginnery, where the existing equipment is actually so old that completely new facilities would be required. At present, Somaltex is ginning all of its cotton at Balacad, where there is sufficient capacity to meet all of the textile mill's ginning requirements. The cotton seed is partly being used for replanting and partly as a raw material for the newly established private sector oil mill. Under these circumstances, it would at present not seem justified to establish new ginning facilities in the Juba valley. However, if cotton production increases beyond existing ginning capacities or a rehabilitation is required at Balacad, this question would have to be reviewed.

The Kismayo Meat Factory is another candidate for rehabilitation, for which different concepts have been proposed by numerous studies. In the short and medium term, the priority should be on making full use of the already rehabilitated corned beef line by aggressively pursuing all possible marketing opportunities. In the long term it might be possible to export more thermally processed or even frozen meat, but this will first of all require to ensure that supply of cattle is reliable and furthermore that Somalia will actually be in a position to sell in the world market. A joint venture with a foreign partner securing the market might probably be the best route for increasing exports of processed meat. Any rehabilitation of the factory will therefore have to carefully take these factors into account.

Rehabilitation is also required at the SLA Tannery in Kismayo. Many studies have been carried out for the leather sector, including the facilities at Kismayo and donors have shown an interest to assist Somalia in rehabilitating and further developing this sector. A condition for such assistance has been, however, that considerable liberalization takes place. At present, this is being reviewed by the Government. Once this issue is resolved, it can be expected that the leather sector will receive substantial support on a national level, including the possible rehabilitation of the tannery in Kismayo.

As a priority item, such assistance would then also include efforts to increase the collection rate of hides and skins and to improve the quality of flaying and curing.

Apart from the raw materials provided by the crop and livestock sectors, the by-products from the industrial processing of these constitute again a raw material base for further processing.

Bagasse is presently used at the Juba Sugar Project to meet the energy requirements of the mill. About two per cent dry fiber is not used, however, and presently wasted. This could be utilized to make charcoal, which would find a ready market in the Lower Juba, where rapid deforestation is taking place. Alternatively, the surplus bagasse could be used as input for animal feed required in conjunction with the proposed stocking route.

Also at the Sugar Project, molasses is a by-product which is presently exported, earning valuable foreign exchange. Molasses could alternatively be used as a feedstock for the chemical industry, especially for the production of alcohol. However, SNAI-Biasa seems to be able to fully satisfy the limited local market in this respect for some time to come. Another alternative would be to use the molasses also as input to the production of animal feed.

At the Fanoole rice mill, the husks are not utilized for the production of process energy and are presently wasted. It should be explored whether the Mogambo mill could utilize this husk. Alternatively, husk might also be used for the production of charcoal.

Milk is a staple diet in the rural areas and produced in considerable quantities. Despite the fact that supply of milk is seasonal and geographically widely dispersed, it should be possible to establish small dairies for producing cheese and other milk products to sell particularly in the urban markets. This needs further exploring.

Of the projects mentioned, it is therefore worthwhile to further explore for implementation in the short term the possibilities of

- producing charcoal from surplus bagasse and possibly rice husks
- establishing dairies for the production of cheese and other milk products.

All other projects mentioned will need to be looked at again when the raw material base comes close to existing capacities and, in the leather sector, when the policies for the sector's further development are defined.

5.2.2 Satisfying Local Demand

The second task of industry in the Juba Valley is, as far as economically possible, to satisfy local demand for consumer and household goods, tools and implements and industrial services. The resource base for these activities is limited not only in the Juba valley, but generally in Somalia. Imports are therefore unavoidable.

The market opportunities and project possibilities in this industrial sub-sector are extremely varied and can quickly develop with changing socio-economic conditions. The enterprises best capable of realizing such opportunities are those in the private sector, most often starting at a very small scale, if the technology allows such an approach.

Because of these characteristics, this industrial activity is best supported not by planning individual projects on a long-term basis, but by establishing institutional support services which can give technical guidance and access to credit to private, especially the small entrepreneurs. A start has been made by having an Industrial Promotion Office and an Industrial Consultancy Unit within the Ministry of Commerce and Industry. A potential danger, however, is that these will concentrate nearly all of their resources on the pressing problems of the public and larger private sector enterprises, with small scale enterprises promotion and support not receiving sufficient attention. It has been the experience in many countries that this problem is therefore best tackled by establishing a separate organization solely for small scale enterprises development. This needs to be done, of course, in a national context, but the Juba Valley could possibly be one of the country's most promising regions outside Mogadishu in this respect and should therefore be considered as one of the first ones to receive such support.

5.3 Benefits

In fulfilling the above two tasks, the industrial sector will make a small but increasing contribution to the people in the Juba Valley achieving a higher standard of living by diversifying the regional economic base, generating employment, providing more value added, saving foreign exchange by substituting for imports and by generating foreign exchange through the export of more and industrially further processed products.

These benefits can, however, only be realized, if the national industrial sector objectives, policies and strategies as defined above will actually be implemented.

ANNEX 11

S O M A L I A

Masterplan for Juba Valley Development

Settlements and Infrastructure

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ANNEX 11

List of Abbreviations

CED	-	Civil Engineering Department
EEC	-	European Economic Communities
ENEE	-	National Agency for Electric Energy
GTZ	-	German Agency for Technical Cooperation
MPWH	-	Ministry of Public Works and Housing
SCR	-	Swedish Church Relief
SGU	-	Socio-Geographic Unit
UNCHS	-	United Nations Center for Human Settlements
WDA	-	Water Development Agency

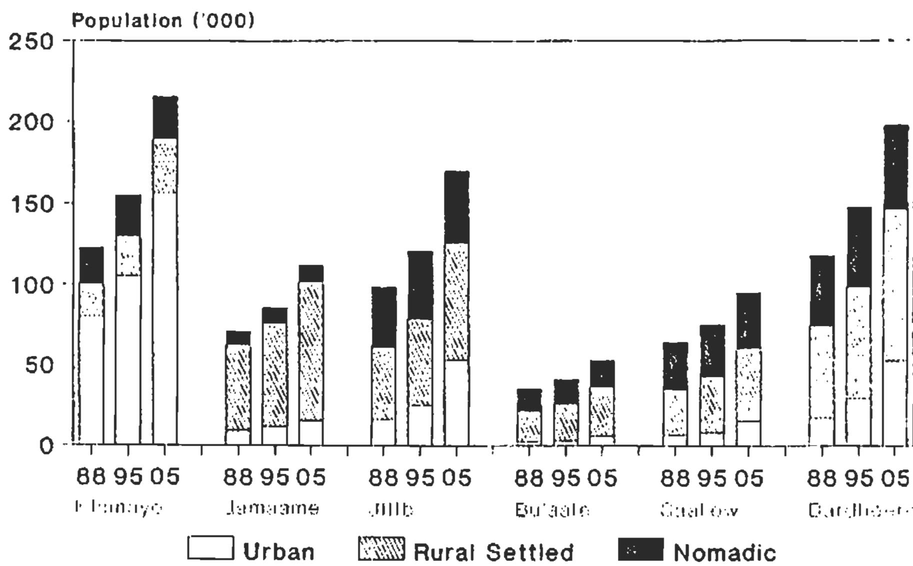
Settlements and Infrastructure

1. Population Data of Study Area

Population data are analyzed comprehensively in ANNEX 3 (Human Resources and Labour). However, considering their importance for settlement and infrastructure planning, the basic figures are outlined in the following.

Figure 1/1 presents the actual population (1988) per district as well as the projected changes for the two time horizons 1995 and 2005.

Figure 1/1 Population in the Study Area

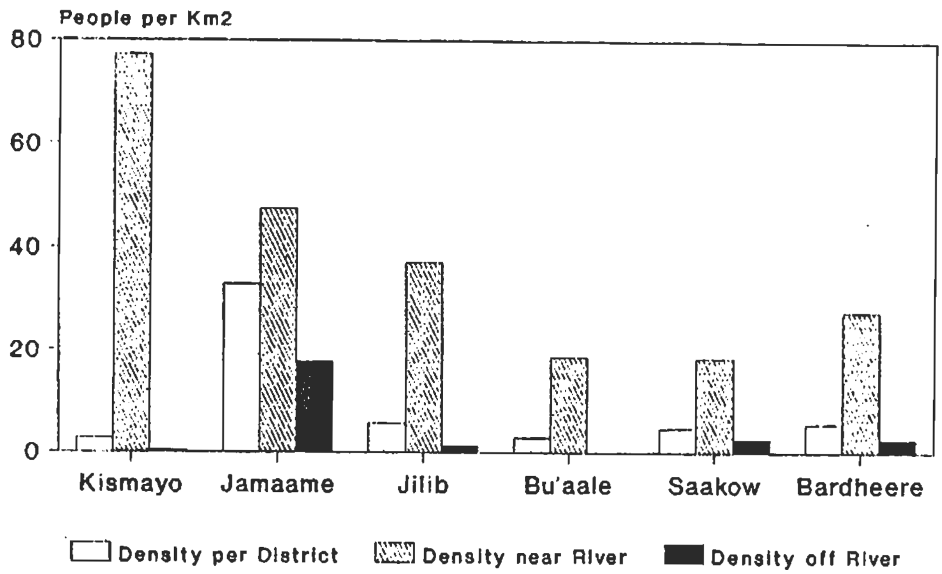


Source: MJVD, SCR, ANNEX 3

The total population in the Study Area consists of some 510,000 people, of which 26% live in urban areas, 44% in rural areas, and 30% belong to nomadic groups. The proportion of 1:2 of the urban (133,000 people) to the settled rural population (222,000 people) indicates a relatively high degree of urbanization. The figures also show, that most of the urban population is concentrated in the southern part of the area, particularly Kismayo, where some 60% of the total urban population lives.

Figure 1/2 presents the population density characteristics in rural areas.

Figure 1/2 Rural Population Density



Source: MJVD, SCR, ANNEX 3

The population projection included in Figure 1/1 reflects some basic planning assumptions, which will be treated in the following chapters as far as they are relevant for regional settlement and infrastructure planning. In general terms, it has been assumed, that

- the urbanization process will concentrate mostly on Jilib, Kismayo and Bardheere

- immigration from other areas of Somalia will take place as a consequence of the Bardheere Dam construction

- sedentarization of nomads will increase, contributing particularly to urban growth

- sedentary rural population growth rates will be relatively low.

By the year 2005, the time horizon for planning within the framework of this Masterplan, the population situation will have changed considerably: The total population will have reached some 840,000 people, distributed over some 3 towns of over 50,000 inhabitants and a number of smaller towns (urban population: 36% of total). The nomadic part of the population will have increased slightly in number, however decreased significantly by proportion to some 22% of the total population. The sedentary rural population will have increased to about 360,000 people (43% of the total population).

It has to be noted that the aforementioned projection scenario constitutes not more than the most probable development trend identified by the planning team on the basis of regional development elements that are known at the time of planning. Updating, as a consequence of monitoring the real development process in the region will permanently constitute an important task of the organization in charge of regional development guidance, leading most probably to a number of modifications over time.

2. Settlements

2.1 Classification of Settlements

The existing settlements in the Study Area have been classified according to their function within the regional context. Two groups of categories were defined on the basis of functional and administrative criteria.

2.1.1 Functional Categories

Cities (Urban centers with more than 50,000 inhabitants), defined by the presence of urban facilities of regional and international importance, such as administrative and public services, industries, commercial and transport facilities.

Primary Urban Centers (Urban centers with more than 15,000 inhabitants) with urban facilities such as administrative and public services, industries, commercial and transport facilities, but limited to relevance within the region or district itself.

Secondary Urban Centers (Urban centers with more than 3,000 inhabitants) with limited, basic urban facilities of regional and district level, such as administrative and public services, small scale industries, commercial and local transport facilities.

Primary Rural Centers, serving as locally important rural service centers with relative large population (approximately more than 1,000 inhabitants). The rural character predominates and urban key facilities in terms of administration and commerce are missing. In some cases they play a specific role or satisfy important sectoral demands (e.g. secondary school at Dujuma).

Secondary Rural Centers, being smaller rural service centers with generally more than 500 inhabitants. It would have some service or infrastructural facilities of relevance for a larger group of villages.

Tertiary Rural Centers, being defined by at least one factor of dominance over a smaller group of unclassified villages such as primary school or health worker.

2.1.2 Administrative Categories

Settlements are in addition classified in four administrative categories according to national standards

Regional Center, capital of a region with the office of the Governor and the regional administration.

District Center, capital of a district with the office of the District Commissioner and the district administration.

Municipality, urban settlement category with the office of a mayor and the municipal administration.

Beel, with the office of a Beel chairman and a Beel council, each representing either an urban subdivision or a group of rural centers and/or villages.

The above administrative subdivisions do exist in parallel: e.g. in Bu'aale, a rather small town and capital of Middle Juba Region, all four levels are represented at the same time, indicating that the hierarchical order of a particular settlement is determined by the highest level of administration represented.

Table 2.1/1 presents the different major settlements of the Study Area and their respective functional as well as administrative categories.

Table 2.1/1 Classification of Settlements

	Functional Categories						Admin. Categories			
	City	Prim. Urban Cent.	Sec. Urb. Cent.	Prim. Rural Cent.	Sec. Rur. Cent.	Tert. Rural Center	Reg. Cent.	Distr. Center	Muni-cipality	Beel
Kismayo District										
Kismayo	1						1	1	1	
Yontoy				1						1
Gobweyn				1						1
Sec. Rural Centers					3					2
Tert. Rur. Centers						2				
Jamaame District										
Jamaame			1					1	1	
Kamsuma				1						1
Mogambo				1						1
Bangeeni				1						1
Suunguni				1						1
Sec. Rural Centers					11					4
Tert. Rur. Centers						15				
Lower Juba Region	1		1	6	14	17	1	2	2	12
Jilib District										
Jilib		1						1	1	
Harawe				1						1
Mareerey				1						1
Homboy				1						1
Sec. Rural Centers					12					6
Tert. Rur. Centers						14				5
Bu'aale District										
Bu'aale			1				1	1	1	
Dujuma				1						1
Sec. Rural Centers					7					5
Tert. Rur. Centers						14				8
Saakow District										
Saakow			1					1	1	
Banaada				1						1
Sec. Rural Centers					5					5
Tert. Rur. Centers						13				13
Middle Juba Region		1	2	5	24	41	1	3	3	47
Bardheere District										
Bardheere		1						1	1	
Barow Dinle				1						1
Sec. Rural Centers					6					6
Tert. Rur. Centers						20				18
Gedo Region		1		1	6	20		1	1	25
Study Area	1	2	3	12	44	78	2	6	6	84
Luuq			1					1	1	
Dinsor			1					1	1	
Afmadow			1					1	1	

Source: District Administration (for administrative categories).

2.2 Settlement Development

2.2.1 Present Urban Settlement Network

In the following, the different urban centers in the Study Area are briefly analyzed with regard to their respective present and future role in the regional context.

Kismayo is the third largest town in Somalia. It has one of the three major ports of the country, an international airport as well as some export oriented industrial facilities. Being the capital of Lower Juba Region, it is the main urban center in the southern part of Somalia. Also, Kismayo is an ancient town with long standing traditions within the context of the early East-African ports. Its history is still expressing itself in a number of valuable buildings which would merit protection as national monuments. Kismayo is located geographically at the tail end of the river system, relatively well connected to the capital by an asphalt road via Jilib. Kismayo has recently been provided with a modern power plant with 24h service. Water supply, however, constitutes a basic and important deficiency: the town is supplied by water from the Juba River. Although this water is being filtered (although, at present, the treatment plant is out of service), during low flow periods of the river the intake is polluted by seawater.

Jamaame is a rather small town which has lost some importance during the past as a consequence of riverbed changes of the Juba River which have increased its isolated location. To this isolation has also contributed the fact that the main asphalt road connecting Mogadishu with Kismayo bypasses Jamaame on the opposite riverbank (however, a bridge and an asphalt link road of some 15 km provide all-weather access). Jamaame is the center of a large part of banana estates along the Juba and of agricultural areas of SGU 6 (1). A particular constraint for the physical structure of the town is its location on difficult clay soils resulting in high construction costs and a permanent risk of structural damage through periodic expansion and shrinkage of the subsoil.

Jilib is a rapidly expanding smaller town at a geographical key location within the Study Area. Also, the numerous agricultural development activities of the southern part of the Juba Valley are centered around this town and have resulted in rather active and fast urban development. Also, the 24h electricity supply from the Fanoole powerhouse has to be considered an important stimulating element of economic growth.

Bu'aale, although classified as the capital of Middle Juba Region is the smallest urban center within the Study Area. This fact is partly due to the particularly difficult linkage to the rest of the country by road, being cut off completely during the two rainy seasons of the year. Apart from the administrative services, only few infrastructural and service functions justify the function of the town as a regional service center.

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1) SGU = Socio-Geographic Unit, for delineation of SGUs see Masterplan for Juba Valley Development, Main Report, Chapter 2.

Saakow, similar to Bu'aale, has serious disadvantages caused by limited road access. However, the town has developed slightly faster because of its hinterland of extensive rainfed agriculture areas (around Banaada). Economic linkages appear to be closer to the northern zone of the Study Area around Bardheere than to the southern part (Jilib/Kismayo).

Bardheere is a town with a fairly favourable geographical location with all-weather road linkages to Mogadishu via Baydhabo and Garbaharey/Luuq. It is the economic center of the northern half of the Study Area, and has developed slightly above average due to numerous activities in preparation of the construction of the Bardheere Dam.

In general, apart from those aspects that have been mentioned earlier in connection with Kismayo and Jilib, all towns in the Juba Valley have extremely rudimentary infrastructure and services.

For the three other towns (Dinsor, Afmadow and Luuq), which are included in the Masterplan for urban infrastructure and service development, the same applies together with, however, some specific aspects: a particularly difficult water supply situation in Dinsor, and another isolated, periodically inaccessible location at Afmadow. In Luuq, a specific situation prevails due to the river morphology at this location with a narrow "oxbow", or meander of the river, where riverbank erosion at any flood situation may cause serious damage to the town.

Table 2.2/1 presents a brief analysis of some main factors, which determine the order of centrality of the different settlements:

Table 2.2/1 Matrix of Service Functions of Central Places

	KIS	JAM	JIL	BUA	SAA	BAR	LUU	DIN	AFM
All weather road link	XXX	XXX	XXX			XX	X	X	
24h electricity supply	XXX		X						
Safe water availability	(XR)	(X)	(X)	(X)	(X)	(R)	(R)		(X)
Hospital	XX	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)
Secondary School	XX	X	X	(X)	(X)	X	X	X	X
Industry (incl. small sc.)	XX		X			X			
Market	XX		X			X	X	X	X
Shops	XXX	X	XXX		X	XXX	X	X	X
Livestock serv. facil.	XX		XX	X					
Agric. service facil.	XX	X	X		X	X	X		
Maintenance facilities	X								
Rural hinterland served	20c	(53d)	45c	19c	28d	57d	N	N	N

XXX - service provided and generally adequate
XX - service fairly adequate
X - only basic amenities/services exist
(X) - operation limited/insufficient
(R) - river water only
20c - 20,000 people in densely populated areas/concentrated in floodplain
28d - 28,000 people in dispersed settlement areas
N - information not available

KIS - Kismayo, JAM - Jamaame, JIL - Jilib, BUA - Bu'aale, SAA - Saakow, BAR - Bardheere, LUU - Luuq, DIN - Dinsor, AFM - Afmadow

It can be recognized from the above table, that the qualitative and quantitative deficiencies of essential services related to basic needs are overwhelming, and that there is a clear decline of levels of provision from South to North. The three settlements having the highest concentration of service facilities do roughly coincide with the importance of their respective rural hinterland and the resulting demand for services, when considering, that most of the population in Jamaame District is more oriented either towards Jilib, or towards Kismayo. The importance of Jamaame as a central place is rather restricted to its immediate surroundings and the areas between the town and the Indian Ocean, the other areas being quite well served by all-weather roads and fairly good communication links to Jilib and Kismayo.

What concerns the physical structure of the different towns, an analysis of the present urban settlement densities is presented in Table 2.2/2.

Table 2.2/2 Urban Population Densities

Town	Population	Surface (ha)	Density inhabitants/ha
Kismayo	80,200	800	100
Jamaame	9,400	100	94
Jilib	16,400	150	109
Bu'aale	2,800	85	33
Saakow	6,800	85	80
Bardheere	17,200	140	123
Luuq	12,000	100	120
Afmadow	5,400	70	77
Dinsor	7,400	80	93
Total	157,600	1,610	98

Source: Own investigation

The population densities in the different town vary from a low figure of 35 inhabitants per hectare in Bu'aale (predominant rural character) to 125 inhabitants per hectare in Bardheere. Kismayo with 100 inhabitants per hectare has a relatively low density for a large city which is to be explained by the inclusion of scarcely populated outskirts and a large industrial zone.

Land for settlement development generally does not constitute a development constraint, because of the general low population density in the Study Area and the presence of extensive areas of non-agricultural land around present settlements. However, low settlement densities do constitute a constraint for an economical provision of infrastructure and amenities.

2.2.2 Present Rural Settlement Network

In general, villages throughout the Study Area are well organized. Traditional socioeconomic and socio-cultural mechanisms are strong enough to guarantee a fairly safe ecological integration of settlements into the natural environment.

Building techniques are well mastered and well adapted to climatic and environmental conditions.

However, the satisfaction of basic needs constitutes a major problem to the village society. This means that a large proportion of family labour is required to satisfy daily demands in firewood and water provision as well as seasonal demands in building maintenance.

The distribution pattern of villages differs quite drastically throughout the Study Area (the same applies to the larger Development Area), as villages are partly rather concentrated near the river, but also high population numbers live in extensive areas away from the river (particularly in SGUs 5 and 6), where rainfed crop production patterns prevail.

By nature of such rather remote rural areas with a (semi-)dispersed settlement pattern, the provision of basic infrastructure is heavily handicapped.

A certain hierarchy of central places has evolved over time (which is reflected both in Table 2.1/1 and in Map "Settlement Network" of the Masterplan Atlas), mostly on the basis of population concentrations, the existence of important basic services, outstanding physical features such as permanent wells with safe drinking water or particularly good road access situations.

This pattern of existing rural centers provides a good basis for development.

2.3 Impact of Bardheere Dam on Settlements

The construction of the Bardheere Dam will have important impacts on existing settlements in three different ways:

- A particularly important consequence of this national project will change the daily life pattern of Bardheere town quite drastically and rather active development of the town will result both from (pre-)construction activities and from the mere presence of this important facility with its continuous requirement of manpower and services.

  In this context, it has to be differentiated, however, between the construction camp, which is planned to be built (within the context of the Bardheere Dam Project BDP) in the immediate vicinity of the future dam, and Bardheere town being located some 30 km away from the dam site.

In the opinion of the Masterplan team the consequences of the Bardheere Dam Project on the town of Bardheere have to be seen within a long term perspective and compared to other dam projects in Africa. It is not felt probable, that the BDP (however large the need for labour may be during the construction phase) will by itself alone lead to a sustained boom of Bardheere town. However, its outstanding geographical location predestines the town in any case for an increased role as a regional growth pole. In the following chapter, a projection has been estimated for this town (as well as for the other major settlements of the region).

- The second impact of the Bardheere Dam project will be (and is already to some extent, due to preparatory activities of different kind) an indirect stimulating effect on economic development throughout the region. This impact materializes in (positive) aspects of increased entrepreneurial initiatives (particularly in major settlements) in expectation of self-induced rising demand, in (negative) aspects of speculation on land for agriculture and urban development; in faster implementation of other infrastructural elements such as regional link roads, and a higher attention to general planning and research needs leading to a more structured development process.

- Finally, the mainly agricultural development, which will be possible through the existence of the dam and its regulatory effect on river hydrology will have a direct impact on settlements in those areas, where this new, guided development will take place. An important aspect in this context will also be the integration of those people, who will have to be resettled from the future reservoir area, and be integrated in a positive way into the socio-economic system of the downstream valley.

A rather specific situation will be created by the dam and its reservoir at Luuq town. This settlement and its topographical location has been a determining factor for the design of the physical shape of the future reservoir. The reservoir will have its northern limit just close to the town, a delta formation through sedimentation will develop and alter the river morphology around the town. This changing pattern may increase the already existing risk of riverbed changes, which would affect the town quite drastically in that the town could potentially be cut by the river breaking through its banks right at the present town center. This risk requires particular attention of planners and early preventative action.

Another similar impact concerns the bridge at Bardheere, where river scour after dam closure may affect bridge foundations.

2.4 Development Potential and Constraints

It can be derived from the above description of the present settlement network, that a fairly well suited hierarchy of service centers exists at all levels, from a major city with inter-regional linkages through a series of favorably located middle size towns down to a network of villages having developed its own hierarchy of centrality functions.

Also, from a socioeconomic point of view, the population has traditionally adapted itself to an adequate distribution of tasks to provide basic services, particularly in commerce, small-scale agro-industrial services (e.g. mills). Administrative subdivisions also appear to be basically adequate.

However, a number of limitations exist, that will have to be overcome by future development, and a number of development constraints limit possibilities for future development.

Lacking potable water resources

This aspect merits particular attention, because it constitutes one of the basic and most crucial limitations, having important repercussions on development concepts.

Practically throughout the entire Development Area, groundwater resources are generally saline with the exception of some non-saline freshwater lenses, which can be located hardly differently than with empirical methods.

Only the Juba River itself presents a substantial resource which presents clear planning parameters. In the present situation, this resources creates constraints only at its lower part (below Kamsuma bridge) because of seawater intrusion during low flow periods. Very unfortunately, this effect has the most severe consequences for the largest settlement of the valley, Kismayo. In the with-dam situation, the Juba River will have a more constant flow throughout its length and will constitute a more reliable source of water for all riparian settlements including Kismayo.

All non-riparian settlements are constraint by a potentially difficult water supply situation.

Dispersed pattern of rural settlements

Particularly in SGUs 5 and 6, high numbers of population live in villages which are scattered over large areas. This dispersed pattern presents an important handicap for the provision of basic infrastructure and services.

Excessively low level of present infrastructure and services

At all settlements in the Development Area, quality and quantity of basic communal infrastructure elements and services are excessively deficient, resulting in the necessity to build up a basic network from the start, a condition which requires overproportionate funding. Due to equity considerations in the overall national context, only a rather modest improvement of the situation can be foreseen without a major risk of overstressing public support capacities.

Sensitive ecological environment

This constraint concerns the aspect of dependence of settled population on products of the natural environment, most clearly on firewood as the main domestic source of energy. Larger urban agglomerations in particular do cause an overextraction of wood in adjacent forest and bushlands, and tend to result in major ecological imbalances. Slow regrowth is a major constraint in a semi-arid climate, and irreversible damages can result from overexploitation.

Lack of access

Large areas of the Development Area are seasonally inaccessible, a major handicap for economic growth, having also severe repercussions on general living conditions.

Need for resettlement

The national project of construction of the Bardheere Dam has the consequence, that substantial settlement areas between Luuq and Bardheere will be flooded, and agricultural land as well as private properties lost. This implies the need for careful and equitable compensation of damages, and the resettlement of an important number of population into areas, where they will find a new basis for existence.

Lack of administrative procedures for development guidance

The present administrative network of public support services (at all levels from local Government to sectoral administrations) is marked by a number of constraints, which hamper the general improvement of living conditions of village and urban communities:

- low salary levels result in low motivation of civil servants to fulfill their tasks

- low budgetary allocations prevent sustained maintenance of facilities and provision of investment and consumption items

- low skill levels, coupled with the absence of financial and physical means prevent a gradual improvement of infrastructure and services

- the lack of adequately defined administrative procedures for settlement planning and development lead to haphazard and unsystematic physical (and economic) development of settlements

- in cases of settlements, which are facing particularly active development due to specific development trends (e.g. Bardheere and Jilib), the present administrative setup will be overburdened dramatically to cope with guidance requirements of a rapid physical and economic expansion.

The above-mentioned constraints for future development are not at all specific to settlement and infrastructure development, they do apply in all sectors of development and constitute basic constraints for regional development. Solutions will primarily depend on high level Government support for regional development by solving structural problems at a national level.

2.5 Settlement Development Projection

In the following, a development projection is presented for the network of settlements in the Juba Valley, based upon findings and planning considerations of the Masterplan team.

Due to their respective location and within the context of the construction of the Bardheere Dam, the two towns of Bardheere and Jilib will develop overproportionately and become increasingly important as major urban service centers.

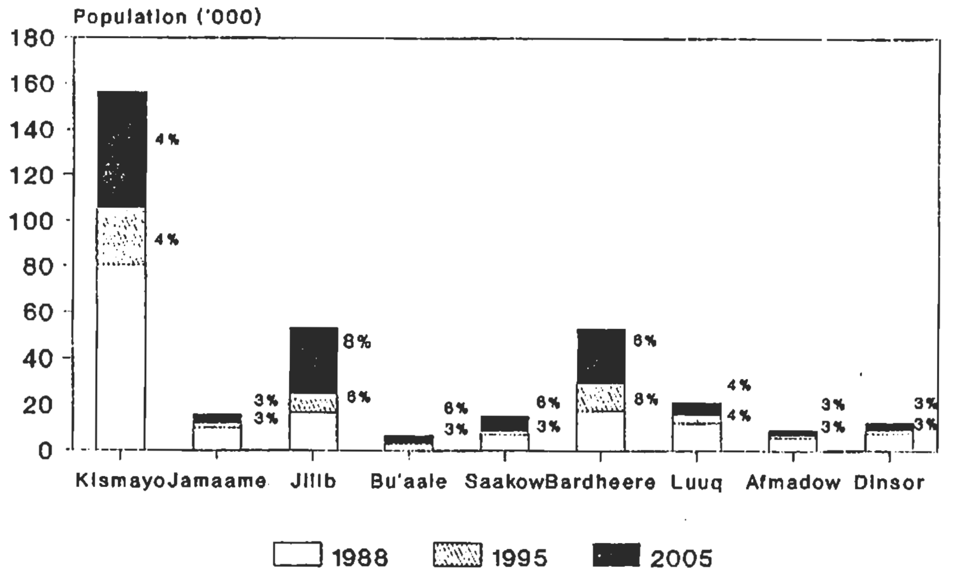
The city of Kismayo will continue to serve as another major service center, however, within the context of regional development in the Juba Valley, its function will be more concentrated on 'supply' and transhipment through its port facilities. Generally, its peripheral location will somewhat limit its service functions to specific aspects. Its physical expansion is estimated at some 105,500 and 156,200 inhabitants in 1995 and 2005, respectively.

Bardheere and Jilib will grow rapidly to large towns with more than 50,000 inhabitants, whereby Jilib will develop rather steadily, but the growth of Bardheere will be directly influenced by the Bardheere Dam project growing fast before, during and immediately after construction of the dam, and reducing its growth slightly and gradually after the completion of the dam.

Jamaame, Bu'aale, Saakow, Luuq, Dinsor and Afmadow will reinforce their role as primary and secondary urban centers. Particularly Saakow and Bu'aale will profit from the improved accessibility and agriculture development in the middle section of the lower Juba Valley. Some of the presently existing primary villages will become secondary urban centers.

Urban population projection for 1995 and 2005 is shown in the following Figure 2.5/1.

Figure 2.5/1 Urban Development



Source: Own estimates

2.6 Development Objectives

The basic objective for settlement development is to reinforce the existing network of settlements by giving emphasis to those towns, which will play a particularly significant role in future regional development - the so-called central places. These towns should be provided with all those resources that would be required to satisfy service requirements particularly of the respective rural hinterland. Only this approach will contribute to avoid or at least reduce an increased rural-urban migration tendency.

In order to be able to fulfill this function properly, it is also essential, that the towns concerned are developing in an orderly manner themselves to avoid internal frictions and irrational use of land resources and consequent loss of efficiency.

The basic approach to urban development should not be too sophisticated and complex, but responding in a rather simple manner to the most urgent requirements.

This should be achieved through increased planning and implementation capacities in the different towns, as far as possible based on existing resources and oriented towards specific local needs.

2.7 Settlement Development Proposals

In this chapter, only those aspects are considered, which are related to general settlement development guidance, aspects such as the provision of sectoral infrastructure and services are treated in the following chapters as well as in other related ANNEXES of this Masterplan.

2.7.1 Urban Development Planning

The development of the Juba Valley will bring about important changes in the social and economic life of the population. The urbanization process in the Study Area will accelerate: the current 132,800 urban population will increase to 180,000 in 1995 and 300,000 in 2005, including upcoming urban settlements. The annual urbanization factor will increase from 4.5% to 1995 and to 5.5% between 1995 and 2005. Settlement policy formulation and its application in planning will be one of the most important tools to channel this development into organic growth and to minimize rural-urban migration towards Mogadishu and Kismayo.

The general objective of settlement planning is to improve the living conditions of the urban and rural settled population, to improve access to social services, to reduce urban and rural disparities and to promote the development of rural regions.

There is no comprehensive system of settlement development planning established in Somalia. At present, town planning is executed by the Ministry of Public Works upon demand and against payment by the municipalities (Ministry of Local Government). The established Town Development Plan serves mainly as basis for the allocation of land for urban infrastructure. It is legally binding for the land development committees responsible for land allocation.

Actually most urban centers do not have any town development plan and the allocation of land is completely under the responsibility of land development committees. To a certain extent, these are assisted by sectoral administration for aspects such as road planning and construction, water supply and drainage etc. Land allocation for urban infrastructure and services is granted without any charges, whereas industrial/commercial land, and land for housing has to be paid for. This payment represents an essential part of the municipal budgets.

The development of town planning to its proper role as framework for future development and basis for any sectoral planning is of high priority especially when major investment in urban centers will take place. However, this can only be done at national level through the following actions:

- strengthening the existing central town planning unit
- implementation of town planning procedures
- modification and extension of the legal structure
- creation of follow-up and control procedures.

To avoid unorganized planning in the meantime a special town planning programme for cities and fast growing urban centers such as Kismayo, Jilib and Bardheere has to be established.

The preparation of urban development plans for these centers would include the following activities:

- creation of a town planning team consisting of officers of the ministries concerned

- preparing cadastral maps and collecting of basic data analysis of the present situation

- defining a development concept which is politically acceptable

- establishing the town development plan.

The other urban centers would be planned in a later phase, when the national concept for town planning is established.

Town planning, at an initial stage should lay emphasis on an appropriate zoning and spatial organization of different land uses.

2.7.2 Planning Priorities for the Different Towns

Kismayo

The city of Kismayo requires the establishment of a town planning team within the municipal administration to elaborate a comprehensive urban land use plan as basis for future physical expansion of the town. This plan will have to consider in particular:

- cadastral inventory of present urban land use
- road links between the port and industrial areas including relevant functional zoning
- physical planning of the port area
- the rehabilitation/improvement of peri-urban slum areas
- the safeguarding of national heritage in the form of ancient building monuments
- the integration of urban amenities, mainly water and electricity supply networks, sanitation and drainage
- the internal (and external) passenger and goods transportation system including necessary roads
- the network of communal services, considering particularly their adequate zoning and accessibility by users
- the gradual buildup of regular planning, implementation and follow-up procedures within the urban administration.

This planning body should gradually take over also the task of providing administrative assistance to rural development throughout Lower Juba Region.

As present know-how is lacking to fulfill these complex tasks, a special training programme is required as well as additional technical support to the municipal and regional administration.

Bardheere

In the case of Bardheere, the same tasks are required as for Kismayo, however with two important modifications:

On the one hand, the aspect of the pending construction of the Bardheere Dam near the town implies a set of particular aspects, which have to be studied and solved differently than in the case of Kismayo, as here a new development element requires specific solutions.

On the other hand, even with relatively rapid urban development in Bardheere, the physical size of this town will by far not be as important as that of Kismayo, but the rather drastic evolution by itself calls for careful and rapid installation of corrective mechanisms well before the actual need arises. This will help to avoid the unfortunate situation of anarchical urban growth due to absent planning and guidance capacities.

In general terms, the following tasks are required:

- cadastral inventory of present urban land use
- the integration of urban amenities, mainly water and electricity supply networks, sanitation and drainage

- the internal (and external) passenger and goods transportation system including necessary roads
- the network of communal services, considering particularly their adequate zoning and accessibility by users
- the gradual buildup of regular planning, implementation and follow-up procedures within the urban administration.

One more specific task in Bardheere concerns the necessity to examine at an early stage the potential effects of river scour following the closure of Bardheere Dam on the existing bridge, and to take early corrective action.

Jilib

In Jilib, the same tasks are required as in Bardheere. The necessity for planning results more from the rapidity of natural urban growth, than from a single defined development element (as in Bardheere).

Other towns

Considering the order of magnitude of efforts, which have to be undertaken in the three main urban centers, it cannot be reasonably assumed that there will be readily available additional planning capacities in the foreseeable future to take up the task of comprehensive urban development planning in the other towns of the valley. However, municipal administrations concerned should be encouraged to draw on expertise in the three main centers and to derive basic planning criteria from those established plans.

Simultaneously, the scope of work of the three urban planning teams should gradually be widened to include the necessary tasks in other urban and rural areas.

2.7.3 Rural Development Planning

Guided development of the rural hinterland is of high importance in regional development. The principle task in this context concerns the satisfaction of the most basic needs of the rural population, potable water supply, health and education services. Considering the strong traditional patterns of community organization, the question of housing is of lesser importance, requiring, however, a certain assistance to decrease the permanent maintenance requirements of traditional buildings. Although not an immediate major concern at present, the procurement of firewood as the main source for domestic energy has to be looked into in order to avoid substantial degradation of the environment.

The issue of rural development planning has to be considered an integrated component of tasks of the respective planning teams of urban centers and growth poles.

These planning teams should elaborate strategies for structural improvement of living conditions within the respective rural hinterland with emphasis on water supply, health and education services. They should in addition set up procedures and mechanisms for environmental monitoring (mainly with regard to the issue of firewood extraction, identify needs for intervention and propose/implement solutions.

2.8 Housing

2.8.1 Types of Houses

Within the framework of this Masterplan a general assessment of the prevailing types of housing (see Figure 2.8/1) has been undertaken.

Type I:
The rural ('Carish') houses with rectangular shape in many cases form a small compound of one to three single houses (each up to three rooms) and with fenced enclosure around an internal courtyard. This type of house consists of a light wooden frame, walls in 'wattle and daub' construction, plastered with clay and sometimes painted with ornamental geometrical pattern and thatched roofs. Most daily activities including cooking take place in the open area in the shaded places close to the building.

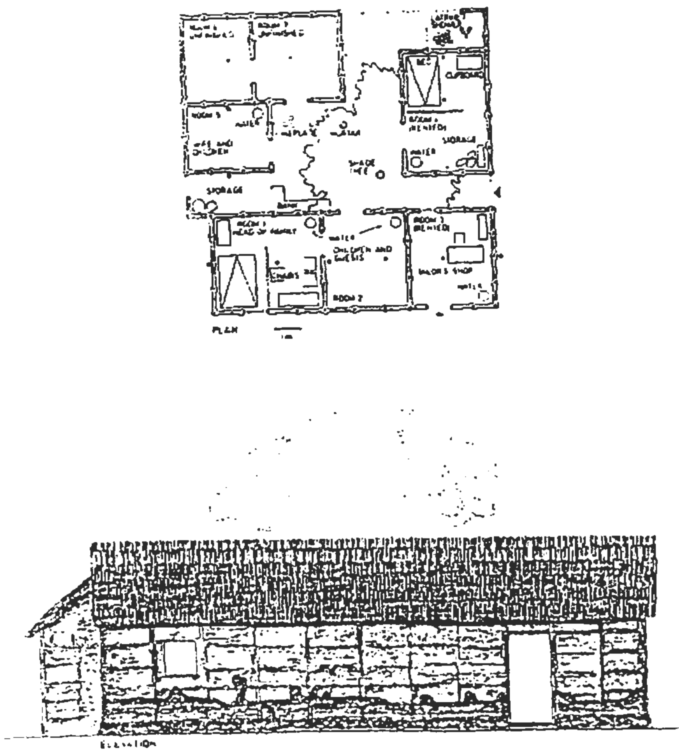
Some of the houses have a fenced pit latrine combined with a 'bucket-type' shower. Personal belongings and other things are stored above ground where possible.

In many cases, the clay plastering of walls is partially left out in order to improve cross ventilation. The houses are normally well adapted to the climate. They are, however, subject to termite attacks. Hygiene constitutes a major hazard, particularly where settlement densities are high. The type of house is dominant in the southern part of the Juba Valley.

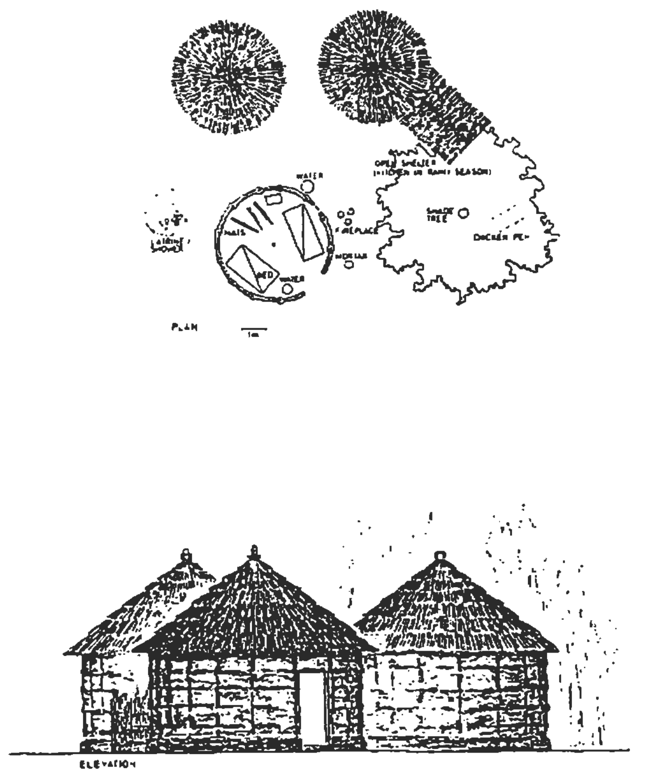
Type II:
This rural house has a circular shape ('Mondul'); it has a more 'rural' character and dominates in the central and northern part of the Juba Valley. The construction principles are identical with Type I. The houses with up to 4 m diameter have one central post used as support for the roof, in cases where huts are larger, the central support is an umbrella-like construction. Compounds are often formed with several huts and kitchens as well as resting places are constructed in the same manner, however, without wall plastering for cross ventilation.

Type III:
The nomadic hut ('Agal') is especially designed for easy dismounting and transport on camels. Sometimes, during migration periods, these huts may also be dismantled and stored on trees until the return of the owners. The wooden sub-structure is built with sticks of an approximate length of 2.0 - 2.5 m bent to arches of almost a semicircle. Assembled with leather strips they form a dome which again is covered with grass mats. A ventilation opening of 10 - 20 cm is left open near the ground level. All equipment and furniture is made of wood and leather and designed to be light and portable.

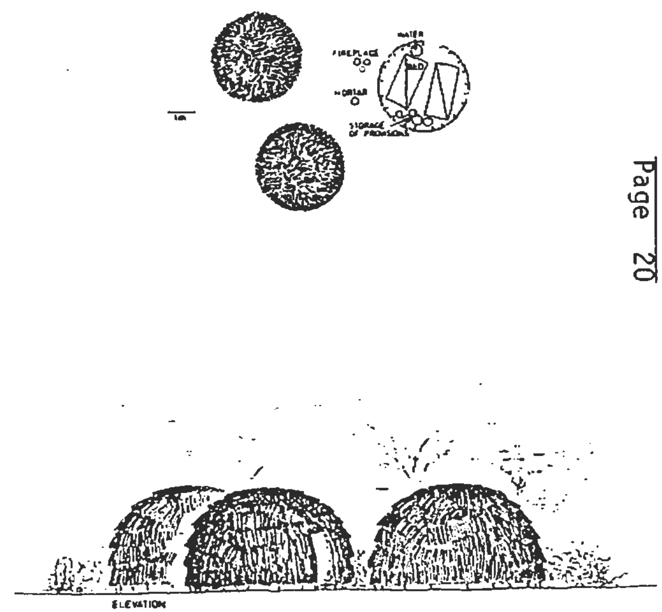
Figure 2.8/1 Typical Types of Houses in the Study Area



Typical Rural House 'Carish'



Typical Rural House 'Handul'



Typical Rural House 'Agal'

Type IV:
The more urban houses ('Sar' and 'Barako') are of various shapes and construction techniques. This category includes all houses constructed with stones, coral, cement blocks, timber with corrugated iron or asbestos roofing that occur mainly in urban centers and are used for housing, offices and other purposes. A differentiation of dominant patterns is difficult with regard to the variety of forms and shapes. However, a strong Arabic influence can be noticed, particularly near the coast.

These types of houses, however, are limited to the central areas of towns and larger settlements and constitute a minority of all houses within a town or larger settlement, the majority being composed of Types I and II around the town centers.

Figure 2.8/2 shows the distribution of the three typical types of houses ('Mondul', 'Carish' and 'Agal') within the six districts of the Study Area.

2.8.2 Development Potential and Constraints

Housing in the Juba Valley Development Area has traditionally developed in an ecologically sound manner. Building materials and techniques are in accordance with socioeconomic structures of the population, and are generally suitable for the prevailing climatic conditions.

However, with increasing population densities, a gradually increasing stress on the natural environment can be foreseen, particularly around larger settlements, concerning the extraction of wood and timber for construction. The effects of overextraction of wood can be observed already today, although still limited to few areas.

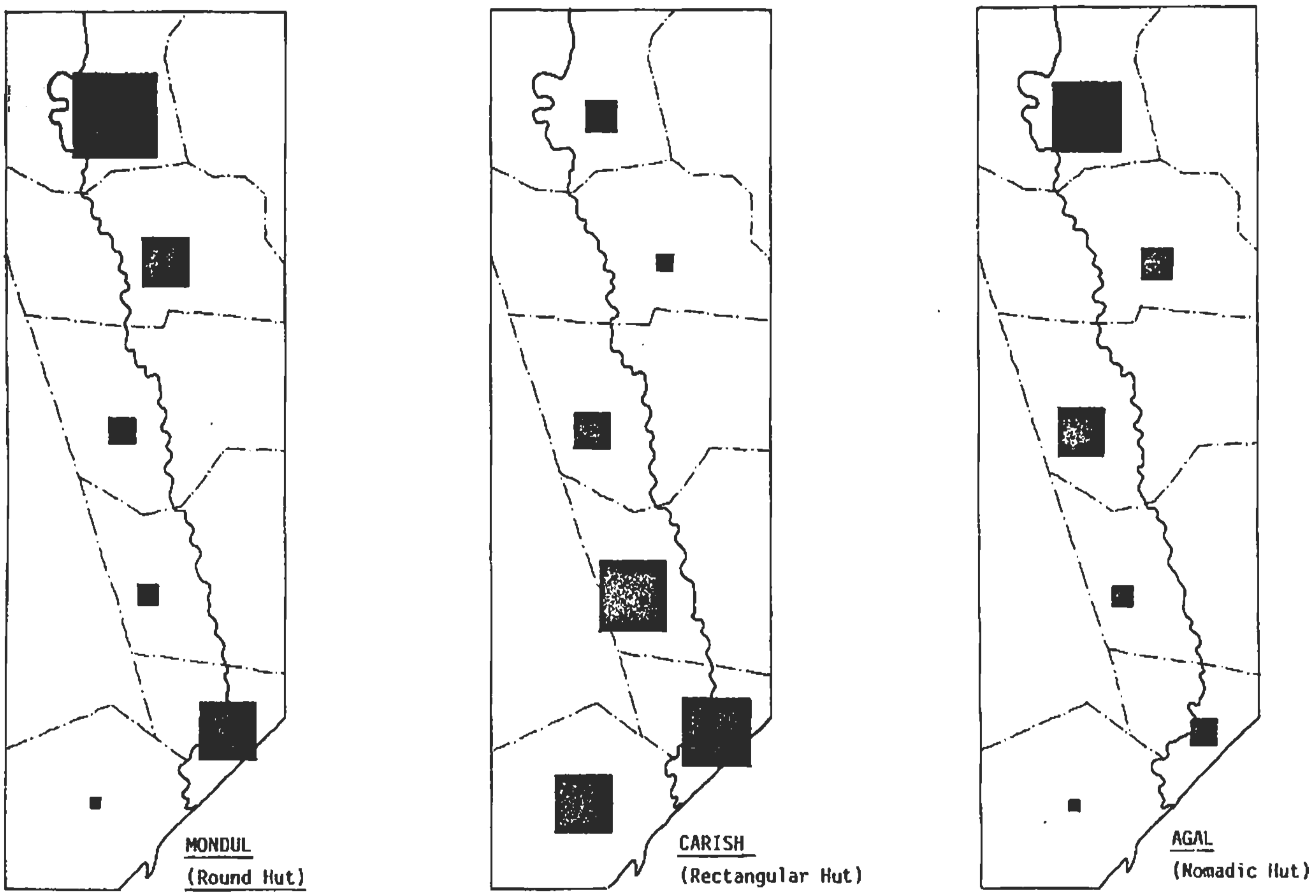
There is a considerable potential of natural building materials:

- coral (in the Coastal Area), clay and wood in Lower Juba Region
- clay and wood in Middle Juba Region
- stones, clay and wood in Gedo Region.

The major constraint in house construction is, that the traditional wattle and daub construction technique is prone to termite attacks and deterioration of the wooden substructure, resulting in lifetime of a construction of little more than five years. This implies high manpower requirements for maintenance

Another constraint prevails through the absence of any adequate site planning in settlements, resulting in haphazard siting of buildings and increasing difficulties to provide infrastructural elements within residential areas.

Figure 2.8/2 Distribution of Types of Houses



Source: [81]

2.8.3 Development Proposals

Development of low-cost housing is the appropriate housing strategy for the Juba Valley. It requires the identifications and development of adequate house construction techniques and materials and training of the artisan builders.

Changing over to wall construction with clay only (similar to many other traditional African construction techniques) could prolong the life of the house considerably, and save wood in the construction process. The United Nations Center for Human Settlements (UNCHS) is actually doing low-cost housing research and appropriate construction guidelines can be expected. Within the context of urban development planning (refer to Chapter 2.7.1), the improvement of urban slum areas (particularly in Kismayo) should constitute an important component, and improved house construction techniques should be developed, tested and implemented within this context and in cooperation with UNCHS.

3. Roads, Transport and Telecommunications

3.1 Roads

3.1.1 Present Road Network

The existing road network within the Study Area is shown in Table 3.1/1.

Table 3.1/1 Road System by Type and District

District	Paved road	Gravel road	Track
	(in km)		
Kismayo	49	8	126
Jamaame	61	28	114
Jilib	46	58	172
Bu'aale	0	0	276
Saakow	0	0	186
Bardheere	0	115	290
Total Study Area	156	209	1,164

Source: Own investigation.

The figure shows that the area is an important part of the national transport network in the southern part of Somalia, with links to neighbouring countries, i.e. Kenya and Ethiopia.

In the 1970's, main emphasis was given to the development of a basic road network with the objective to connect the major area centers with Mogadishu. Although the total length of paved and gravel roads increased considerably during the period from 1975 to 1984, large portions of the Study Area can be reached by earth tracks only. These tracks are temporarily impassable during the rainy season.

The Study Area is linked to Mogadishu from both ends, in the North from Luuq and from Bardheere via Baydhabo, and in the South from Kismayo via Jilib.

The remaining road system within the Study Area and its adjacent districts consists - with few exceptions around Jilib, Kamsuma, Jamaame and Bardheere - of earth tracks only. During the rainy season the north/south communication is quite often interrupted due to floods, resulting in destroyed roads.

In the following, the more important roads are described, as well as their condition and status of planning, construction, rehabilitation and/or maintenance. All minor road connections will not be mentioned directly or in detail since these are practically without exception simple sand or earth tracks.

The most important link to the Study Area is the Mogadishu - Kismayo national link road via Jilib. The road was constructed since 1984, but is already heavily degrading, as the bitumen layer is too thin (section between Brava Junction and Jilib). Besides that the drainage pattern of the lower Shebelli river under high flood conditions was not sufficiently taken into account (insufficient cross structures). At present a complete rehabilitation of the section Brava junction to Jilib is necessary.

The road from Jilib to Kismayo as part of the a.m. axis was constructed more than 20 years ago. It is an asphalt concrete construction with a 60 mm bearing and 40 mm wearing course on a stabilized base. This road has received very little maintenance (one repair since construction) and has reached its life span. Being the major link from Kismayo to Jilib (Mogadishu and Bardheere), this road was and still is used by fairly heavy traffic, e.g. trucks with maximum axle load of 15 tons. Extreme heavy traffic occurred especially during the implementation of the Juba Sugar, Mogambo and Fanoole projects, as well as during the rehabilitation of the Jilib to Mogadishu road. This has resulted in embankment failures at several places around Mogambo and Kamsuma. In addition to the heavy traffic, the same road sections are subject to be flooded with water flowing over the road to either side, consequently weakening base and sub-base and causing erosion along the shoulders.

Other important roads within the southern part of the Study Area are designed to serve specific projects. Examples are the asphalt road between Araare and Jamaame and the road Kamsuma to Mareerey as a newly constructed 7 m wide gravel road serving the Juba Sugar Project. The latter is maintained by Juba Sugar and in reasonable condition. The road between Jilib and Fanoole/Malenda as part of the north/south communication link was constructed by the Fanoole Project as a 6 m wide upgraded feeder road. This road lacks regular maintenance and significant deteriorations can be observed.

All other roads or connections within the southern and central part of the Study Area, i.e.:

- the link to the North with the regional center of Bu'aale
- the roads between and to the district centers of Saakow and Bardheere
- the connecting roads to various villages and settlement areas, as well as
- the links to the riverside where intensive agricultural development can be observed,

are simple tracks, partly not even 4 m wide. During the rainy seasons, Bu'aale as the regional center of the Middle Juba Region (located along the road between Jilib and Bardheere) as well as Saakow are cut off from the rest of the region up to six months yearly.

The capital of Gedo Region, Garbaharey, is connected with Bardheere through a gravel road of which 30 km are completely destroyed and actually not existing anymore.

Another road to Faxfaxdhun, starting in Bardheere, is at present under construction by the Somali Government as a gravel road. The district of Dinsor recently received a new access road coming from the Bardheere - Baydhabo road. Another important place, Afmadow, towards the Kenyan border with Liboi as the border post, can be reached on a track only.

Although the north to south link on the east bank of the Juba River between Bardheere and Jilib is extremely poor and cut off frequently during a year, it is the only possibility for the population of the Middle Juba Region to communicate in the two directions.

In 1986 and after submission and approval of a feasibility study, a design study was prepared for the road between Bardheere and Jilib along the left bank of the Juba River, being the central section of the north to south axis in the Juba Valley. Because of the importance of this north-south axis within the national (and even international) context, a feasibility study was prepared, followed by a final design study in 1986 for the construction of an all-weather road between Jilib and Bardheere.

The standard adopted was a 9.5 m wide gravel road with a 6.5 m carriage way in its first stage and with a double surface treatment including possible strengthening of base at a later stage, depending on traffic volumes. The traffic volume is estimated to date and for the next years with at about 50-75 commercial vehicles per 24 hours. In relation to traffic intensities expected, the structural design has been limited to 10 years, leaving the possibility for adjustment at a later stage.

On the west bank of the river, between Mareerey and Bardheere, only villages close to the existing river crossings at Bu'aale and Bardheere can be reached by vehicles more or less throughout the year. The remaining part is cut off during the rainy season.

The northern link road between Bardheere, Baydhabo and Mogadishu was recently rehabilitated by the Government. Starting as an 8 m wide gravel road at Bardheere, the road turns into a 6.5 m tarmac road approximately 56 km before Baydhabo (with a surface dressing), from where it proceeds to Mogadishu.

The stretch between Baydhabo and Afgoi was rehabilitated in 1984/85 as part of the World Bank Road Project IV.

At present, there are no plans for starting a regular road maintenance scheme. The World Bank Road Project IV which included a road rehabilitation programme, is now in its interim phase where plans are being worked out for a possible maintenance scheme for all major roads.

Such a programme will not commence before 1989/90 if finance can be secured. Beside the preparation work for such a programme, a Road and Highway Act as the legal support has to be prepared since no legislation on road transport is existing.

The road network is administered by the Ministry of Public Works and Housing, Civil Engineering Department (CED), responsible for planning, construction supervision and maintenance of roads.

3.1.2 Urban Road Network

Only Kismayo as the largest urban center within the Study Area is served with at least a skeleton of a surfaced road network with an approximate length of about 8 to 9 km. This network consists of a tarmac surfaced main road throughout the town and leading to the airport, with the port access road as a concrete construction branching off from the main road, and an access road to the meat factory.

The remaining part of Kismayo and all other settlements within the Study Area do not have any properly designed road system, except for a few cases where a settlement is passed by one of the roads mentioned under the rural roads. At this point in time, there are no existing plans to alter this situation.

3.1.3 Road Maintenance

At present, maintenance operations are rarely carried out due to lacking funds, equipment and personnel. They are restricted to minor and emergency repairs, often applying inadequate techniques and materials. Sections of the track between Jilib and Bardheere are sometimes maintained after rainy seasons by equipment made available by the large scale projects in the South, such as JSP or Fanoole, against payment of diesel by district administrations.

Public sector maintenance activities are practically not existing. This implies that (donor funded) construction projects periodically require reconsideration, in most cases complete new construction before the normal life span has been reached.

Unfortunately, also the absence of proper supervision during construction leads to low quality standards from the beginning, and would lead to increased efforts in road maintenance in order to guarantee sustained use of road communication links.

3.2 Transport

3.2.1 Road Transportation

Transportation is mainly carried out by cooperative and private owners of trucks, pickups and busses. For emergency transport purposes, such as transport of seriously ill persons, or transport of essential goods, the vehicles of the police service and of the army are used occasionally.

Passenger transport is generally restricted to the areas with relatively good road access (Kismayo, Jamaame and Jilib in the South, and Bardheere in the North) with two linkages to Mogadishu (from/to Bardheere and Jilib).

Within the other areas, passengers are forced to take advantage of any type of vehicle, mainly trucks, for transport circulating with extremely low frequency.

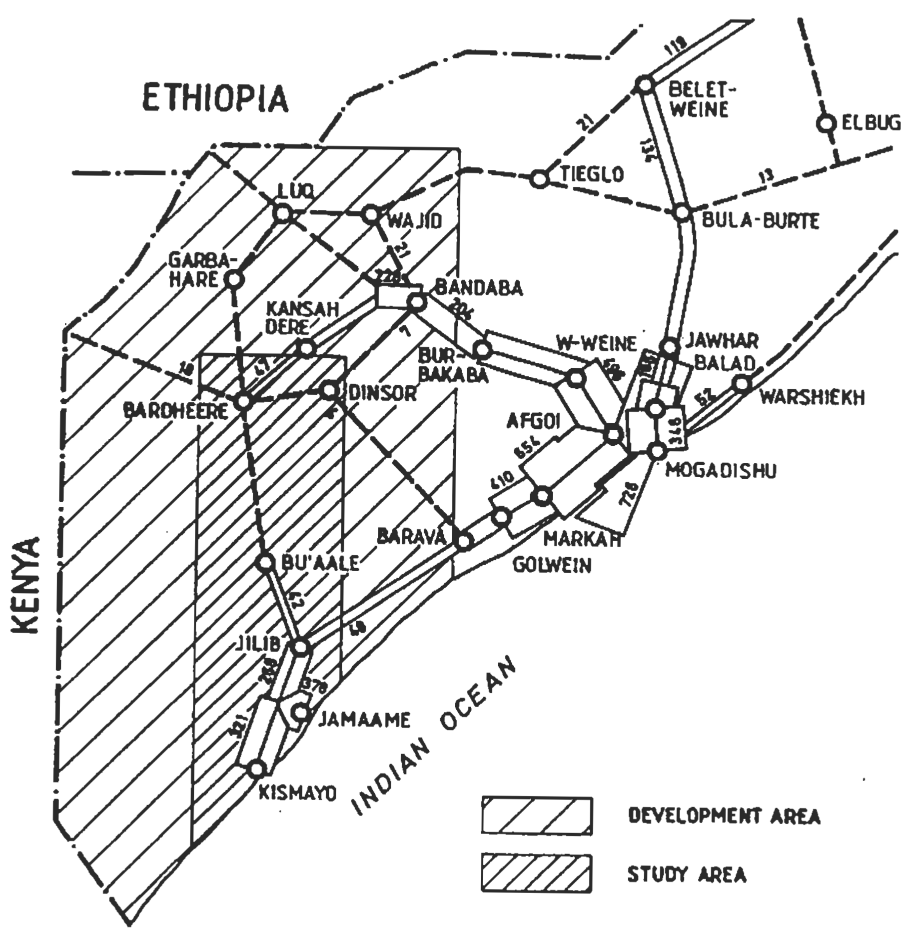
What concerns goods transportation, the situation is very much similar, a specialized aspect of transportation being the transport of bananas to Kismayo and to regional markets.

Public transport is limited to the support of Government-run service facilities such as ADB-stores and to some basic support to regional and district administrations, mainly supply of fuel (however, these supplies are provided only occasionally and irregularly).

The transport of agricultural produce is done either with the equipment of the various agricultural enterprises (sugar, bananas, rice) or by private truck owners who come during harvest time to buy produce directly from farmers.

A National Transport Masterplan is presently being elaborated by the Ministry of National Planning.

Figure 3.2/1 Traffic Volumes (1985/86)



Traffic volumes are rather low throughout the Development Area in comparison with Mogadishu, or international traffic density standards. The highest volumes on an average normal weekday occur in the vicinity of major centers as well as around densely populated agricultural areas and mainly in the southern part of the Study Area. Traffic counts as conducted in August 1986 by the Ministry of National Planning resulted in an average of 380 vehicles on the road between Jamaame and Kismayo of which 30% was purely goods transport.

The north to south daily traffic count between Bardheere and Jilib showed a total of 42 vehicles of which 60% were trucks transporting goods and people. The latter is in line with the estimates of the design study for the Bardheere - Jilib road, being 50 to 75 commercial vehicles daily for the period up to 1995 and thereafter.

All other roads and tracks within the Study Area have marginal traffic volumes in terms of vehicles; they are mainly used by donkeys and donkey carts. Table 3.2/1 shows the 12 hours average traffic volume on specific road sections with the Study Area.

Table 3.2/1 Traffic Volumes per 12 Hours

Road section	Passenger transp.	Goods transp.	Total
Bardheere/Jilib	16	26	42
Kamsuma/Jilib	149	119	268
Jamaame/Kismayo	266	114	380
Qansadh./Bardheere	18	29	47
Ceel Waaq/Bardheere	6	12	18

Source: [51]

3.2.2 Air Transport

Four airports of international standard exist in Somalia: Mogadishu, Berbera, Kismayo and Hargeysa. The latter has some limitations as to the size of aircrafts it can handle, because of limited runway length.

Kismayo airport, having a rather high standard, is used for internal flights only. The number of domestic flights departing from Kismayo, for the time being only to Mogadishu, decreased over the past years from 280 per annum in 1982 to 71 in 1985, and to a present total of 52. The main reasons given for this decrease are the lack of suitable planes and unattractive flight frequencies. Some improvement is expected now that the national airline has been provided with three new twin engine commuter planes for domestic services.

The low density of domestic flights is quite surprising, considering the long distances, the difficult terrain, the underdeveloped road network, and the lack of alternative transport systems.

Apart from the airport of Kismayo, the Study Area has airstrips in Bardheere, Saakow, Bu'aale and Jilib. At present, these airstrips have no importance.

The Juba Sugar Estate also has an airstrip which is used for the aircraft of JSP management for flights to Mogadishu and Nairobi.

3.2.3 Sea and River Transportation

Except for a considerable number of small ferry services (several dozens of cable ferries and over 100 canoes) for passengers, there is hardly any river transportation existing apart from some firewood rafts between the northern extremity of the Development Area (Dolo) and Luuq and Burdhubo, supplying mainly the different refugee camps.

In general, the ferry services consist of old military boats, tied to a steel rope and pushed by the river current; others with canoes or rowing boats are the main connections for people living in villages on the west bank of the river which cannot be reached by other means of transport. Onward transportation of goods between the ferry points and sale or administrative centers is done by either walking or using donkey carts or camels.

Kismayo is one of the major ports in the country, mainly for the export of agricultural produce to overseas countries, with a small portion only for the import of general goods and oil products. The total number of ship arrivals reached 93 in 1985 which represents about 17% of the total number of arrivals in Somalia.

The main products exported are bananas to Saudi Arabia and Italy and cattle to Arabic countries.

Coastal shipping along the Somali coast as part of the domestic transport system or to neighbouring countries is practically not existing.

3.3 Telecommunications

The telecommunication system is extremely rudimentary and confined only to regional or district centers. In general the telecommunication system is a radial system with orientation towards Mogadishu. Communication within the Juba Valley is only by radio (for emergencies) through the police service. The telephone and telegraph system (with manual exchange) only connects Jilib, Kismayo and Bu'aale with Mogadishu.

3.4 Impact of the Bardheere Dam

The Bardheere Dam will have some important consequences for the network of roads as well as on transport patterns and telecommunications networks.

Around Bardheere town, and between the town and Mogadishu, road links will be considerably improved within the context of dam construction.

The Bardheere Dam project has already had an indirect impact on the programming mechanisms for the construction of major link roads (e.g. Jilib - Bardheere road).

The dam will improve the economic viability of road construction projects within the floodplain by reducing the need for extensive flood protection measures within road structures, thus reducing construction and maintenance costs.

Concerning the other elements such as transport and telecommunication, the construction of the Bardheere Dam will have indirect effects on increased and more active development of economic activities.

The dam and the reservoir will have an impact on three bridge structures: Luuq, Burdhubo and Bardheere:

Luuq: This bridge is located at the extreme northern end of the future Bardheere reservoir. It requires further study what concerns effects of riverbed changes and delta formation on its structure prior to dam construction.

Burdhubo: a bridge has been completed in 1988 linking Baydhabo/Luuq with Baydhabo. This bridge will be submerged by the Bardheere reservoir.

Bardheere: the bridge at Bardheere will most probably be affected by effects of river scour and consequent weakening of foundations. This issue will require studies within the context of the Bardheere Dam project.

3.5 Development Potential and Constraints

The aspects of roads, transport and communication constitute some of the most basic deficiencies for regional development.

The development potential concerns the comparatively active agricultural production within the region and a network of favorably located service and marketing centers. However, the development of these sub-sectors is constraint by a number of important factors:

- long distances over areas with low population densities
- unfavorable soil- and climate characteristics, coupled with delicate drainage conditions rendering road construction and maintenance relatively expensive
- lack of funds, skilled personnel and equipment of the sub-sectoral administrations
- comparatively high dependence on imported material and equipment both for road construction and maintenance.

It is evident, that the physical presence of an adequate network of (all-weather) roads is the most important aspect of development by providing the basic infrastructure for increased (entrepreneurial) activities in the transport sub-sector.

3.6 Development Objectives

The development objectives within this context are to provide a relatively simple, but efficient physical road network, where the permanent use (all-weather roads) and low maintenance requirements have priority over either a particularly dense network or the design speed specifications or road width.

For the whole transport sector, the most crucial aspect of all is sustained and efficient maintenance of roads. Therefore, particular emphasis should be attached to this issue.

With regard to the transport sector itself, it is judged, that the private sector particularly will, as it has proven in Somalia as well as in other African countries, respond in a sufficiently flexible manner to guarantee the necessary mobility of people and goods.

What concerns telecommunications, this sub-sector is considered within the regular competence of the post and telecommunication administration of Somalia. In relation to specific telecommunication requirements (early warning system of dam operation concerning flood forecasts), proposals are also included in ANNEX 2 (Water).

3.7 Development Proposals

3.7.1 Road Development

Two major road projects at national level are foreseen:

- construction of the Jilib - Bardheere road
- upgrading of the Baydhabo - Bardheere road to a metalled road as part of the Bardheere Dam construction.

These two projects can only be seen as part of the national road plan which implies that the rehabilitation of the existing network gets priority. Therefore the Mogadishu - Jilib - Kismayo road, especially the Brava - Jilib section where actual construction did not need design specifications, would have to be rehabilitated at an early stage.

The strategy for the medium term should be:

- the completion of the national road system in the Development Area, i.e. the construction of the Baydhabo - Luuq road and the road link between Jilib and Afmadow (Liboye)
- the connection of all regional and district headquarters to the national road network by all-weather roads:
  - . link road to Dinsor from the Bardheere - Baydhabo road
  - . construction of the Bardheere - Luuq road via Garbaharey (including rehabilitation or new construction of the bridge at Bardheere)

- district access roads to important development areas:

  . access road from Jilib to Juba Sugar Project/Mareerey including a bridge over the Juba River at Jilib (included in the National Five-Year Development Plan)

  . access road from Saakow to right bank agricultural areas, including a bridge over the Juba River

  . an all-weather road connection all along the right bank of the Juba River between Bardheere and Jilib

  . access road from Bardheere to Jilib on the right bank of the Juba River

  . access road from Bardheere to Faxfaxdhun

- rehabilitation and extension of the primary road network to metalled roads in urban centers, including drainage facilities, as a basis for a comprehensive urban (storm water) drainage system

- construction of a rural all-weather road network (earth roads where soil conditions are favourable).

The implementation of this overall road programme requires investments to be safeguarded by a maintenance strategy which would require establishing a network of maintenance units within the Development Area and training of personnel:

- major maintenance units would be required based in Kismayo, Jilib and Bardheere for major repair work and maintenance

- smaller maintenance units in all other district centers to carry out minor repair and maintenance work

- minor units at village level, operated by the villagers themselves with basic support (e.g. food for work scheme).

Within urban centers, and at a medium to long term perspective, metalled main roads should be constructed in accordance with urban development plans.

3.7.2 Telecommunications

Telecommunication sector should equip all district headquarters with automatic rural exchange units with a capacity of 200 connections and possibilities of extension, especially in Luuq, Bardheere and Jilib. Further, there should be a direct line from Luuq to Kismayo and a connection between Afmadow and Dinsor. It would be desirable to tap renewable energy sources for telecommunications networks (power supply by solar energy) for better and sustained performance, for reducing maintenance costs and as a demonstration of such modern techniques for increasingly widespread application.

4. Water Supply, Sanitation and Drainage

4.1 Water Supply

4.1.1 General

Water generally constitutes one of the basic needs of people having also important repercussions on public health. Consequently, significant emphasis must be placed on the issue of water supply for the purposes of the present plan.

Responsibility for the urban and rural water supply is with the Ministry of Water and Mineral Resources and its Water Development Agency (WDA). This organization is the authority for the execution of programmes comprising the development of urban water supply systems in Mogadishu and all other regional and district centers. In addition, the Water Development Agency is also funding the construction of wells for village water supply.

In the Juba Valley, the WDA is represented in Kismayo with two separate offices. One office is responsible for the deep well programme together with the urban water supply, the other for the shallow-wells programme.

Deep and shallow wells are also constructed by private developers and governmental and non-governmental organizations outside the Ministry of Water and Mineral Resources, being the Ministry of Livestock, and Swedish Church Relief in Bu'aale and Saakow Districts, GTZ (Luuq) and Caritas (Jilib).

In the case of deep wells, their establishment must be licensed by the Ministry of Water and Mineral Resources, normally with laboratory analysis at this time conducted in Mogadishu to determine the water quality. After this initial testing, no other quality control is normally done.

4.1.2 Urban Water Supply

Kismayo has a piped water supply system, together with a water treatment plant at Yontoy, which uses water from the Juba River. The Yontoy treatment plant (36 km outside Kismayo) has an average potential output of some 3,000 m^3 per day if in full operation. The water is pumped to Kismayo through a 16" pipeline. During low flow periods of the Juba River, the water becomes highly saline due to salt water intrusion from the sea.

Apart from Kismayo, this pipeline serves the village of Gobweyn and the orphanage in Luglow with public standpipes and few private and public connections.

In Kismayo, approximately 2,500 consumers (of which around 50 are public) are connected. In addition to the house connections, water is also distributed by about 20 public fountains. Consumers are either charged with a flat rate per annum or pay according to meter reading. According to the WDA in Kismayo the system cannot meet more than half of the amount required. Standards would allow the supply of approximately 48,000 people, considering that the average water consumption of urban population would not exceed 60 l/day/person. However, as this standard appears to be rather on the high side, the whole population of Kismayo could be served on the basis of some 35-40 l/day per capita.

Table 4.1/1 Water Supply Systems in Urban Centers

Urban Center	Source of Drinking Water	Length of Piped System	Additional Sources	Water Quality	Remarks
Bardheere	river	-	-	poor	no treatment
Saakow	1 DTW	1.5 km	STWs	fresh to fair	-
Bu'aale	1 DTW	1.5 km	STWs dug wells	fresh to fair	-
Jilib	1 DTW	3.5 km	dug wells	fair	-
Jamaame	3 DTWs	-	dug wells	fair	-
Kismayo	river	2,500 house connections	dug wells 20 standpipes	poor	water treatment plant out of order network under re-habilitat'n 3 DTWs under construction
Luuq	river	-	STWs	poor	STWs and dug wells out of order
Dinsor	harvesting	-	-	unsuitable	no suitable ground water (salinity)
Afmadow	dug wells		STW harvesting basins	fair/poor	-

DTW - Deep tube well
STW - Shallow tube well

The present system is subject to leakages, and the Yontoy treatment plant urgently requires rehabilitation, as presently is no water treatment can be done apart from settling of silt. The entire filtering and pumping system of the plant has to be replaced.

Jamaame is supplied with water through three deep wells of which one has an additional 6 m^3 overhead storage tank connected to a public fountain. In general, the water is collected by the population from the wells through a number of private commercial water sellers who collect water in drums against payment of a small toll at the pumps.

Apart from the large-scale projects at Mogambo, Fanoole and Mareerey with their own water supply systems, the three district centers of the Middle Juba Region are equipped as follows:

- Jilib is partly served through a deep well with a 12 hp pump, which was installed in 1979. The total supply network is approximately 3.5 km long, and has a number of additional hand pumps. Water quality is good.

- Bu'aale as the regional center has a deep well with a 20 hp pump connected with a 6 m^3 high level storage tank. The pipe system is about 1.5 km long and broken. In addition, four boreholes with handpumps were installed recently by the Swedish Church Relief (SCR). Water quality is good.

- Saakow has the same installation as Bu'aale, but only three additional wells (drilled also by SCR). Water quality is good.

The urban centers of the Gedo region are suffering from very difficult conditions. The town of Bardheere is entirely dependent on untreated river water. The water is collected either by the population itself or distributed by water sellers using donkey carts. Unfortunately, as all groundwater in Bardheere and the surrounding areas is highly saline and therefore not potable, the only alternative for safe water supply would be a water treatment plant using river water.

In Luuq, the situation is similar to Bardheere, however, with slightly greater chance to find non-saline groundwater. Few handpump operated wells have been constructed (by GTZ), but these are no longer operational due to lacking maintenance.

Afmadow has another deep tubewell with pump and water quality is good. There is no piped supply network.

In Dinsor, the water supply situation is rather dramatic, as neither non-saline groundwater nor river water are available, the only source being runoff water, collected during the rainy seasons in a large water harvesting reservoir, constructed with EEC funding in 1985. This reservoir dries up during the dry periods leaving the population without any drinking water during several months (an emergency supply by water tank trucks is provided when the situation becomes particularly difficult). In addition, the water from the reservoir is consumed without any treatment.

4.1.3 Rural Water Supply

According to information, the WDA itself through its branch office in Kismayo constructed about 30 shallow wells in the past, all of which are located south of Jilib. Within the Development Area, a number of shallow wells are existing in the villages, constructed either by private individuals, Government institutions and other organizations (Ministry of Livestock).

The only significant well drilling programme in the Development Area north of Jilib is that of SCR in Bu'aale and Saakow Districts.

SCR's programme for rural water supply constitutes a complement to the primary health care programme on the basis of the conclusion that health care, as a prophylactic element has to include the aspect of safe water use and sanitation/hygiene.

The objective of the programme is to supply each Beel with at least one safe water source.

Apart from this, the main water sources for the rural population are as follows:

- River Watering Points ("Hilo") along the Juba River: places where people and livestock are sharing water under extremely dangerous hygienic conditions. The water is generally muddy and polluted at these places, because no adequate access structures are present.

- The same applies also to the flood-plain depressions ("Deshek"), used for water supply by humans and livestock.

- Water harvesting basins ("War"), where hygienic conditions are even worse than in the above two cases, as water bodies are stagnant over long periods, and natural biological cleaning processes are lacking due to small water volumes.

- Shallow and deep wells constructed with the assistance of the Ministry of Livestock and equipped with diesel pumps, mainly introduced to provide water for livestock, are also used by villagers.

The water is collected in simple containers transported by people, in drums fixed on donkey carts, and in wooden/leather containers on camel back.

4.2 Water Quality

The water obtained from the various deep wells is relatively safe and of good quality, particularly when pumped from riverine fresh water lenses. This kind of water supply is, however, available to the minor part of the population only.

The quality of the water coming from the various shallow wells varies considerably. In some cases the wells are lined, covered and properly kept, and no livestock is able to reach the place directly. Unfortunately, many of the wells are neglected and polluted. Results from the various drilling programmes and observations within the Development Area have revealed that the groundwater found in most areas along the river in a depth of 20 to 30 m is of good quality. Mainly in the Gedo region serious salinity problems exist which reduce the exploitation possibilities of groundwater for public water supply considerably.

4.3 Impact of the Bardheere Dam on Water Supply

With the construction of the Bardheere Dam, generally two major influences on water supply can be identified:

- the regulated river regime will improve the water supply situation in the riverine zone, particularly in SGU 4, where sea water intrusion will be prevented permitting as such a reliable supply to Kismayo

- water quality will generally improve as salt peaks occurring at the onset of rainy periods will no longer occur, and sediment load will be considerably reduced.

However, considering the secondary effects of dam construction on irrigation development, a certain risk will persist, that salinity levels in the river will increase again due to irrigation water return flows.

4.4 Development Potential and Constraints

The main and most important potential for water supply is the Juba River itself. The river could easily supply all potable water that is needed in the Development Area. However, as pipes supply cannot be considered for rural areas and small towns outside the immediate riverine zone for economical reasons, this part of the population has to be supplied by tapping groundwater and other surface water resources.

River water, due to relatively high flow velocities is relatively safe and requires only simple treatment.

With regard to groundwater resources, very unfortunately the hydrogeological conditions throughout the Development Area are highly heterogeneous, and locations of fresh underground water can by no means be identified in a systematic manner; drilling of wells generally is a hazardous enterprise, and it is expensive because a considerable number of boreholes have to be established for trial purposes only.

4.5 Development Objectives

Water supply has to be regarded with the highest priorities for regional development, as it satisfies the most basic need of people and has essential implications for public health.

However, as public finance resources are limited, a simple approach has to be adopted, based on the objective to serve a maximum of population with a minimum of funds.

This can be achieved, if efforts would be made in parallel in urban as well as remote rural areas to achieve soon a minimal, basic supply network. This means particularly, that it should be avoided to construct comprehensive piped urban supply networks with a high number of individual house connections, but to limit urban supply to the most essential pipe connections (hospitals, schools) only and to serve the rest of the population with public standpipes at strategic locations and within acceptable walking distances. This approach would minimize cost requirements and set funds free for more widespread intervention to the benefit of rural population.

With regard to nomads, one basic element in future development must be the undisturbed access to the river at traditional watering points. This aspect, however, concerns the issue of land management and guidance to (irrigated) agriculture development. Still, the sub-sectoral administration responsible for water supply, should take over the task of providing simple access structures at these watering places to make their use more safe.

In terms of time sequence, the objective would be to provide safe water supply installations first and to develop distribution networks in a subsequent stage.

In terms of spatial sequence, the most needy places should be served in the order of population concentrations served.

Finally, a high priority is attached to the issue of maintenance, as this appears to be the most efficient and economical factor for sustained availability of potable water.

4.6 Development Proposals

4.6.1 Water Supply

Four different development components for domestic water supply are proposed:

- improvement of water supply for Kismayo
- improvement of water supply for Dinsor
- water supply to rural areas
- water supply to other urban centers
- establishment of a network of maintenance facilities.

Plans to rehabilitate the Kismayo water supply network are already in the pipeline. During 1988 the construction of four deep tubewells should increase the actual daily output from 2,000 m^3 to 3,000 m^3. However, the rehabilitation of the treatment plant at Yontoy (capacity 3,000 m^3 per day) and the main pipeline between Yontoy and Kismayo should be accelerated. The second step should be to rehabilitate and extend the distribution network so that 80% of the population can be supplied either by house connection (10%) or standpipes (70%). At a later stage, a specific water supply study for Kismayo should be carried out and appropriate extension of the network implemented.

In the case of Dinsor, an emergency plan for the rehabilitation and improvement of the existing water harvesting basin is required.

The measures to be envisaged would concern mainly:

- partial covering of the water surface to reduce evaporation losses
- transformation of the existing concrete basin into a sand/charcoal filter
- water quality monitoring on site
- establishment of maintenance procedures
- a study for further improvement alternatives for water supply.

Rural water supply is in a poor shape and has to be improved immediately. Apart from some few villages, which are privileged to have a safe well already, in a first stage, one well should be constructed in each Beel following the example applied in Saakow and Bu'aale Districts by the Swedish Church Relief. Where this is not possible because of groundwater conditions, small and simple filters should be constructed at surface water collection basins (or other water bodies) to improve the use of surface water. This latter solution particularly would require intensive efforts (in cooperation with staff of the health and education service) to increase awareness of the population concerning health risks related to water and motivation to use facilities properly.

At the same time, maintenance of existing water supply installations should be undertaken in order to bring those back to use which have been abandoned for lack of maintenance and spare parts (see also below).

Water supply to other urban centers would concern the rehabilitation and extension of the existing distribution networks with pipe connections and public standpipes.

Priority should be given to the supply of Bardheere and Luuq, where the dependence on exclusively river water constitutes a major handicap. In Bardheere, a treatment plant would be needed with a filtering system. In Luuq, the possibility of supply by pumped groundwater from riverine fresh water lenses would be a short to medium term solution (rehabilitation of three existing broken handpump wells would be an immediate improvement).

In Jilib, some handpump wells have recently been constructed in addition to the deep tubewell equipped with a diesel pump. A further improvement would comparatively be of lower priority. The same applies to Jamaame, Afmadow, Saakow and Bu'aale.

The design standards to be applied (for medium term development) should be approximately as follows:

- water consumption standard:
  . house connection: 80 l/person/day (standard in the National Five-Year Development Plan: 130 l/p/d)
  . standpipes: 20 l/p/d (5-year plan: 50 l/p/d)

- overhead storage reservoirs in urban centers:
  . Kismayo: 1,000 m^3
  . Jilib, Bardheere, Luuq: 200 m^3 each
  . other towns: 20 m^3 each

- approximate length of pipe network/number of public standpipes:
  . Kismayo: 25 km/50 stp
  . Jamaame: 3 km/7 stp
  . Jilib: 5 km/10 stp
  . Bu'aale: 2 km/5 stp
  . Saakow: 3 km/5 stp
  . Bardheere: 4 km/10 stp
  . Luuq: 4 km/12 stp
  . Dinsor: 4 km/8 stp
  . Afmadow: 2 km/5 stp

- maximal walking distance to public standpipes (in urban areas): 300 m.

Maintenance as in other sub-sectors, is the major problem of water supply systems, and has led in the past to important losses of investments. In order to improve the situation, the following components are proposed:

- establishment of central maintenance units in Kismayo, Jilib and Bardheere, equipped for major repair works, replacement of installations and their periodic maintenance. The same applies for rural supply systems

- establishment of maintenance units in each district headquarter to carry out minor repairs and replacement with spare parts

- training of mechanics.

4.6.2 Sanitation

Sanitation as another basic infrastructure and service requirement is directly linked to safe water supply and is an integral part of the effort to improve public health care. The development concept is divided as follows:

- construction of appropriate sanitation facilities in
  . Kismayo
  . other urban and rural areas

- organizing solid waste disposal in urban centers

- construction of drainage facilities in urban areas.

As part of the regional and rural development strategy, the five-year plan foresees the provision of 'demonstration latrines' and sanitation facilities, such as septic tanks in selected areas. It would be appropriate to commence such a programme in the larger urban agglomerations, particularly Kismayo, and to extend it in second stage to Jilib and Bardheere.

The concept for other urban and rural areas would be defined through the implementation of a pilot project. For such a project, the town of Saakow and the nearby village of Gurmeyso are proposed, representing each a typical situation for smaller urban and rural areas. This projects would

- identify suitable materials, techniques and types of equipment
- develop standard designs for basic sanitation facilities
- make proposals for implementation on self-help basis
- develop a sanitation concept for urban centers and rural areas.

The second phase would be the implementation of sanitation facilities in urban centers and rural areas in accordance with the following guidelines:

- setting up units in all urban centers and selected beels for producing sealplates and rings for pit latrines

- construction of sanitation facilities for
  . public and administrative buildings
  . marketplaces
  . selected locations as public latrines

- assistance to implement private sanitation facilities in accordance with standards defined through the pilot project.

All activities to improve sanitation should be undertaken in close cooperation with health and education staff to increase people's awareness concerning sanitation requirements.

4.6.3 Solid Waste Disposal

It is proposed to create a controlled and supervised waste collection and disposal system in all urban centers.

The main bottleneck for organized waste collection and disposal is the general lack of funds within local administrations, especially in larger towns like Kismayo, where waste collection requires at least some specialized equipment.

In order to optimize investment, the improvement of waste collection and disposal would require:

- construction of a sufficient number of waste collection points with a maximal walking distance of about 200 m

- selection of ecologically safe locations for waste disposal within the vicinity of the respective settlements.

The responsibility for these activities should be with town planning teams and local Government administrations.

4.6.4 Drainage

Insufficient drainage of storm water contributes to poor sanitation conditions in settlements, creates environmental hazards and causes erosion, particularly when compounded by high intensity rainfall patterns. In connection with the elaboration and subsequent implementation of urban development plans, particularly the layout of road networks, this issue should be considered.

5. Energy Supply

5.1 Electricity

The supply of electricity within Somalia is organized by the National Agency for Electric Energy (ENEE) which is represented in Kismayo by a regional manager.

The ENEE provides the administrative and technical support including installation and maintenance of the generating facilities and plants. Except for Mogadishu and Kismayo which have a permanent power supply, all other urban centers in Somalia are supplied with electrical power only during evening hours.

Within the Study Area the total installed capacity ranges, depending on the level of the river at Fanoole, from a minimum of 0.2 to a maximum of 4.9 MW for all rural and urban settlements. Other power plants are only partly considered, since they were installed to serve for project specific purposes only. Table 5.1/1 provides some details.

Table 5.1/1 Electricity Network in the Study Area

Location	Capacity (MW)	Year	Hrs. of supply
Fanoole	0.2 - 4.6	1982	24 (seasonal)
Kismayo	2 x 1.000	1986/87	24
Jamaame	0.030	NA	irregular
	0.200	broken	
Jilib	0.200	not operating	
Gobweyn	0.030	NA	6
Yontoy	0.015	NA	6
Bulo Guduud	0.100	NA	6
Water treatment plant at Yontoy	0.250	not operating	
Bu'aale	0.030	NA	4
Dujuma	0.080	NA	NA
Saakow	0.050	1975	6
Bardheere	0.100	1976	6
Dinsor	0.050	NA	6
Luuq	0.080	NA	6
Afmadow	0.030	NA	6
Total	3.445 - 7.845		

NA - information not available

Source: District Administration

Compared with the survey undertaken in 1984 [65], a significant change can be observed. Kismayo has received a new power station with a capacity of 2 x 1 MW, including a new high and low voltage distribution network. The project is in operation since mid 1987. The capacity installed exceeds the peak demand of the whole area presently supplied, the present peak demand being about 0.7 MW. Consequently the power station has sufficient reserves to supply additional industrial and private consumers.

The powerhouse of the Fanoole Project has an installed capacity of 4.6 MW with a standby capacity of 200 KW which are presently used to supply Jilib and Kamsuma. However, the supply depends on the river water discharge and has to be interrupted at times when the water flow is either too high or too low.

The power stations at the other large scale estates and factories (e.g. Juba Sugar Project) are exclusively used for project purposes.

Apart from the a.m. supply systems, quite a number of other public generating plants are in operation under the responsibility of the Ministry of Local Government within the Study Area ranging from small to medium sets with 15 to 250 KVA.

Mainly in the district centers, a number of private small generators exist in shops and workshops.

5.2 Other Energy Sources

5.2.1 Fuel Wood

Firewood and charcoal in Somalia are practically the only domestic energy source in rural as well as in urban areas.

Apart from the larger urban centers, where a serious to extreme pressure on vegetation has already led to degradation of the natural environment (one of the most serious cases that can be observed in that respect is the degradation (desertification) around the refugee camps near Luuq), in general the regeneration capacity of the vegetation cover is still sufficiently strong. However, intensified use as a consequence of further urbanization and concentrated development will increasingly result in further and even more severe degradation of resources, if appropriate measures are not taken early.

In any case, the procurement of firewood and charcoal constitutes a serious limiting factor within the subsistence farming systems in rural (walking distances and time spent) and urban (cash expenditure requirements) areas. Apart from a fixed price for charcoal and a restriction on the type of wood used for charcoal production, there are no attempts to improve the situation on national, regional or local level.

5.2.2 Wind, Solar Energy, Biomass

Neither of these energy sources are utilized so far in Somalia to any sensible extent, despite the fact that solar energy is abundant, and winds are steady and strong (trade winds), particularly in coastal areas.

On a pilot scale (wind generating plant in Mogadishu) and in very few specific cases such energy sources are used. Examples in the Development Area are:

- solar refrigerator in the health post of Dinsor
- solar domestic power supply in Saakow and Bu'aale (SCR)
- use of biomass by-product (bagasse) in the Juba Sugar Factory for power generation.

In all these cases, the use is economical and efficient. In the case of few wind driven water pumps, each installation has failed due to lack of maintenance after a short period of operation (Jamaame and Dinsor hospitals).

The potential presented by these energy sources is considerable and requires serious consideration.

5.3 Impact of Bardheere Dam on Energy Supply

The permanent provision of a substantial amount of electric energy from the future Bardheere Dam is one of the most essential economic justifications of the dam project itself. The total foreseen output of about 105 MW from the Bardheere powerhouse will be fed into two main power transmission lines:

- to Mogadishu via Baydhabo (60% of output), and
- to Kismayo via Jilib (40% of output).

This amount of energy (about 40 MW for the lower Juba Valley) will be available for distribution. However, the demand for energy will be considerable, particularly when the pumping stations of Juba Sugar Project and Mogambo would be connected (for JSP alone, 12-15 MW would be required). It can be assumed, that the amount of electric energy supplied from the Bardheere Dam powerhouse will be sufficient to cover urban and (agro-)industrial demand of the region until about ten years after dam construction. After that time, most probably further electrification will require additional power sources.

It can also reasonably be assumed, that rural electrification cannot be foreseen for two reasons. First, the total energy output from the dam will be limited, allowing not more than a basic electrification, second, the dispersed pattern of rural settlements does not appear to justify an excessively expensive rural electrification scheme. The latter is to be seen also within the context of national supply and service standards in Somalia.

5.4 Development Potential and Constraints

It is obvious from the above, that the Juba Valley is rather privileged what concerns the supply of electric energy from the Bardheere Dam within the National context.

Also, with regard to other renewable energy sources, climatic conditions are extremely favourable in the area.

This tremendous development potential, however, is compromised by two groups of basic limitations:

- electricity supply networks are expensive and require sustained support in hard currency (despite savings will be generated through reduced oil imports); they require in addition a considerable amount of skilled manpower for operation and maintenance

- the use of other renewable energy sources cannot readily be judged to be easily accepted by local societies, and the sustained availability of installations, again, will require skilled manpower and efficient administrative support.

5.5 Development Objectives

Considering the aforementioned constraints, the development objectives for the energy sub-sector are easily derived:

- improving professional skills as early as possible to guarantee sustained maintenance and operation of networks constructed in connection with the Bardheere Dam

- providing support facilities with sufficient skilled personnel, financial and material means for efficient management

- supply to urban and (agro-)industrial enterprises in response to the most urgent needs

- find alternative means of using other renewable energy sources (wind and solar energy)

- substituting the use of firewood and charcoal wherever possible by simple alternative technologies

- apply the most effective management methods in relation to the use of vegetation as an energy source, including:

  . reglementation of firewood and charcoal extraction

  . increasing the incremental wood production, particularly within the zones of influence of larger settlements (forest/bushland reserves and firewood plantations)

  . motivation of the population to plant trees for wood production wherever this is feasible

  . find alternative techniques of energy consumption (e.g. fuel efficient cooking stoves) and motivate people to their use.

5.6 Development Proposals

The improvement of the energy supply situation has to be seen in two stages: before the presence of the Bardheere Dam, and after that time.

During the first stage, the main task would be in general terms to prepare the system for the time, when the arterial powerline from Bardheere to Kismayo would be installed.

However, as the time of power availability is still relatively far, it appears necessary to foresee a number of interventions to improve the local situation in the short term, by rehabilitating the existing generators, and to improve the regular supply of fuel in order to improve the reliability of services

Another approach for early implementation concerns a programme, starting with a pilot (trial) project for use of wind and solar energy. This approach includes the particular objective to find appropriate solution for rural energy supply.

In the cases of Luuq, Dinsor and Afmadow (similar to other settlements, that are not to be connected to the main powerline from Bardheere Dam), the issue of rehabilitation/improvement of urban energy supply has to be seen under the perspective of permanent dependence on fossil or other renewable energy sources.

The long-term strategy for energy supply of the Juba Valley is rather complex, and has to planned in connection with the Bardheere Dam, supplemented by specific sectoral studies concerning the supply systems to be envisaged including their technical layout.

The presently unsatisfactory energy situation is basically due to a general lack of proper maintenance. A sound maintenance programme requires the following components:

- establishment of central maintenance facilities (including mobile workshop units) in Kismayo and Jilib to carry out major repairs and replacement of energy installations

- establishment of maintenance units in all other district centers

- conducting training courses for local technicians and users.

Much attention has to be given to the continuous supply of spares and supplies.

The issue of firewood and charcoal production is treated in ANNEXES 4 (Crop Production) and 8 (Range and Forestry).

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List of Abbreviations

AMREF	-	African Medical and Research Foundation
BOR	-	Bed Occupation Ratio
CDC	-	Curriculum Development Center
CHW	-	Community Health Worker
DFLEC	-	District Family Life Education Center
DH	-	District Hospital
DHC	-	District Health Center
DMO	-	District Medical Officer
FLEC	-	Family Life Education Center
JESS	-	Juba Environmental and Social Studies
MCH	-	Maternal and Chield Health Care
MoE	-	Ministry of Education
MoH	-	Ministry of Health
PHC	-	Primary Health Care
PHCP	-	Primary Health Care Posts
PHCU	-	Primary Health Care Unit
RFLEC	-	Regional Family Life Education Center
RH	-	Regional Hospital
RMC	-	Regional Medical Coordinator
SCR	-	Swedish Church Relief
TBA	-	Traditional Birth Attendants
TBC	-	Tuberculosis
WED	-	Women's Education Department
WHO	-	World Health Organization

Social Infrastructure

1. Health

1.1 State of Health

1.1.1 Diseases

The health condition of the population in the Juba Valley is characterized generally by poor resistance to diseases. This weakness results from insufficient nutritional and dietary habits originating from subsistence-level agriculture systems in which protein and vitamin supply is far below the needs. As a consequence, most people are anaemic and easily affected by a number of diseases.

The poor health conditions are highlighted by the following three standard indicators:

- infant mortality rate: 15% (7th highest world wide)
- child mortality rate: 26% (7th highest world wide)
- maternal mortality rate: 1.1% (3rd highest world wide).

To date no comprehensive health survey has been undertaken in the Study Area. Only two sources of information are available, which, however, allow only a very rough assessment of the health situation.

In the following Table 1.1/1 the most frequently mentioned diseases of the two surveys are given in the order of occurrence:

Table 1.1/1 Prevalence of Diseases

Swedish Church Relief	Baseline Survey
Malaria	Malaria
Respiratory Diseases	Respiratory Diseases
Diarrhea	Diarrhea
Intestinal Worms	Polio Meningitis
Schistosomiasis	Tetanus
Eye Infections	Intestinal Worms
Skin Diseases	Cholera
Veneral Diseases	Skin Diseases
Tuberculosis	Schistosomiasis
	Tuberculosis

Source: [81] [89]

It is obvious that the results of the two surveys coincide to a high degree. However, by nature of such field investigations and considering that both surveys are not based on medical records, they do reflect to a large extent the personal awareness of people. Therefore they may not in all cases reflect an objective and fully realistic listing of diseases in their actual order of occurrence. One example for this conclusion is Tuberculosis, where according to general agreement among medical staff in the region, the prevalence is very high, whereas in both surveys the disease ranks rather low.

A possible explanation for the inconsistency concerning TBC might be that people themselves classify the disease as 'respiratory disease' as they cannot judge the symptoms of TBC correctly.

In the following the different diseases are briefly discussed on the basis of the two surveys and incorporating findings of field investigations. Unfortunately, the analysis can only be qualitative and limited to rather general statements.

Malaria is by far the most common disease. Apparently, at least half of the total population is suffering from an endemic form of the disease.

In case of respiratory diseases a similar occurrence is evident. As has been explained above, a clear differentiation with TBC is difficult.

Another common group of diseases is intestinal parasites and diarrhea where the occurrence seems to be as high as in the case of the above-mentioned diseases.

Concerning schistosomiasis, findings indicate another high level of endemic occurrence.

As for the other diseases known in the region, no specific conclusions can be drawn.

It is evident that the most common diseases are either waterborne or water-related, or they are infectious diseases that are spread by direct contact.

For the health situation of infants in particular, one rather interesting source is available, which, however, concerns an area outside the vicinity of the Juba River: the record of the Maternal and Child Health Care programme in Dinsor (unfortunately, neither the total number of population concerned, nor the age group of patients are known). The following list reflects the prevalence of children diseases by order of magnitude for the two years 1984 and 1985 as an additional reference:

Whooping Cough
Measles
Influenza
Malnutrition
Anemia
Diarrhea
Worms
Stomach Pain
Eye Infection
Malaria
Skin Diseases
Ear Diseases
Accidents and Poisoning
Burns.

Taking into account that typical infant diseases dominate the above list and that the geographical location of Dinsor outside the riverine area certainly has an influence, it can be seen that in general terms the prevalence of diseases confirms the findings concluded above, particularly those referring to malnutrition, anemia, diarrhea and intestinal parasites. One exception appears to be related to TBC for which no cases have been reported.

1.1.2 Attitudes towards Health

The previous section has concentrated on the prevalence of diseases within the rural settled part of the population living in the riverine area of the Juba Valley.

The poor health situation encountered is to a large extent caused by a general lack of awareness concerning domestic hygiene, the proper treatment of water and concerning proper nutrition requirements. The following example may substantiate this: while river water and water from stagnant pools are the main water sources, people not only take this water for drinking, but they appear indifferent that such water of already doubtful composition is additionally infested by human and animal excretae and other pollutants.

Even though many people are aware of the health risks of such water use, they show a high degree of indifference.

This is all the more disastrous in that other sources for drinking water are rarely available.

In addition to water-related problems, poor hygienic conditions within households as well as in and around villages constitute another major health risk. According to the JESS Baseline Survey, only one fourth of rural households have pit latrines. Neither in villages nor in towns are there any properly organized and efficient waste disposal systems. Considering the climatic characteristics in the area, it is clear that environmental conditions are predestined to spread infectious diseases.

The above is aggravated by the poor nutritional status of the people. They are caught in a vicious circle: with their poor diet and resulting low resistance, they are easily affected by diseases; this reduces their labour capacity, which, in turn, does not allow them to increase and possibly diversify their food production.

It appears that the nutritional status of nomadic parts of the population is generally better, as the dietary composition of their food is more balanced.

Attitudes of people towards health are also determined by certain traditions which are sometimes in conflict with health requirements. A fact which supports the adherence of people to certain questionable traditional treatment methods (which may in some cases also be beneficial) is the following [81]:

In case of illness more than twice as many cases were reported in which people consulted either traditional healers or religious persons for treatment rather than regular health staff. Common treatments are "reading the Koran" and application of herbs (equal in proportion to modern drugs).

The small proportion of people consulting regular health staff for treatment is not only to be explained by the general lack of health facilities but also by a basic attitude of indifference and lack of knowledge.

1.2 Health Facilities

1.2.1 General

Public health facilities are under the Ministry of Health which is represented in all regional and district centers by Coordinators (Regional Medical Coordinators - RMC and District Medical Officers - DMO). In the past, health services were centralized in urban areas and were based on a 'top down approach'. Due to the high investment and maintenance cost of such a system coupled with low area coverage, the programme has proven inefficient, as full coverage in a large country as Somalia with low population densities and scarce financial resources is difficult to achieve. The general constraints for providing efficient health care services in Somalia become even more obvious when considering the extremely low national budget allocation to the health sector of 1.3% (1987).

Therefore, the Government has recently adopted the strategy of a referral system of Primary Health Care (PHC) according to international (WHO) standards as a basically preventive health care system constituting a complement to regular health care programmes which are rather curative-oriented.

1.2.2 Regular Health Care

The nucleus of the regular health care programme is still composed of the District- (DH) and Regional Hospitals (RH) with standard equipment and staffing provided by the Ministry of Health. Table 1.2/1 indicates the situation of these health facilities in the Study Area.

Table 1.2/1 Regular Health Facilities in the Juba Valley

District	Hospital DH/RH	Number of beds	BOR (%)*
Kismayo	1 RH	100	10
Jamaame	1 DH	30	10
Jilib (1)	1 DH	-	-
Bu'aale	1 RH	20	10
Saakow	1 DH	10	10
Bardheere	1 DH	30	10
Study Area	2 RH/4 DH	190	-
Afmadow	1 DH	20	-
Dinsor	1 DH	20	10
Luuq	1 DH	34	10

Source: [138]

1) Building not usable.
* Bed Occupation Ratio.

The table shows that according to the respective administrative status, all urban centers are equipped with facilities. However, as can be seen from Table 1.2/2 below, the level of provision is extremely low even if compared with overall national standards. Also, the number of beds is only an indicator for the physical size of the respective facility. Neither are all these beds available for use nor does the general standard of the facilities permit their proper use. This conclusion can be drawn from the bed occupation ratio and the fact that there were hardly any inpatients present in the hospitals during the field evaluation.

Table 1.2/2 National and Regional Indicators for Health Care

Area / District	Population	Population per physician	Population per nurse	Population per other paramedical staff
Kismayo	122,700	20,540	5,577	2,921
Jamaame	71,000	-	10,142	3,227
Jilib	98,600	98,600	32,866	1,825
Bu'aale	35,300	35,300	7,060	?
Saakow	64,400	-	64,400	?
Bardheere	118,400	118,400	39,466	16,914
Study Area	510,400	63,800	12,448	?
Somalia	6,500,000	18,465	4,234	?

Source: [138]

In addition to the statistical indicators concerning health facilities, their quality is generally insufficient in various respects:

- premises are inadequate and of low standard
- medical equipment and drugs are lacking
- qualified staff is lacking
- laboratories, x-ray units and operation facilities are almost non-existent
- water and energy supplies are insufficient both in quantity and quality
- transport possibilities are practically nonexistent.

In Jilib the present hospital is not used as the building is unsafe.

With the exception of the RH Kismayo being supported by Chinese physicians and where a simple operation theatre exists, no operations or x-ray investigations can be executed in the whole Study Area. Evacuation of serious cases is practically impossible throughout the area.

The same situation as described above, prevails in Dinsor, Luuq and Afmadow Districts.

1.2.3 Primary Health Care (PHC) Programme

In the recent national development plan the Government has adopted the above-mentioned Primary Health Care approach. This programme, prepared since 1978, has actually started in 1982 with the purpose of covering the whole of Somalia, except Mogadishu. PHC is an integrative system, where other health care programmes such as the Maternal and Child Health Care (MCH) will be included as soon as the PHC has achieved full coverage of the Nation and has been sufficiently consolidated. The Annual Development Plan 1987 states that the PHC Programme had already been extended to eight regions. By 1991, PHC is planned to cover all regions of Somalia. The intention is to implement so-called "PHC Posts" at Village level, "Primary Health Care Units" at 'Beel' level and "Primary Health Care Centers" at District or Regional level.

In the Juba Valley, PHC programmes exist in the districts of Bu'aale and Saakow, sponsored and organized by the Swedish Church Relief (SCR) and in Jilib, where it is supported by World Concern. PHC Programmes are also being started in the Lower Juba Region (in Kismayo and Jamaame Districts) being sponsored by UNICEF. In Luuq District, the African Medical and Research Foundation (AMREF) started supporting PHC in early 1988. In Bardheere, Dinsor and Afmadow districts, there are no plans yet.

The PHC Programmes in Saakow, Bu'aale and Jilib consist of basic PHC teams at district level, which are composed of one nurse, one midwife, one laboratory technician, one sanitarian, one assistant pharmacist and one driver each, trained by the Swedish Church Relief (SCR) and the World Concern teams respectively.

One community health worker and two traditional birth attendants are working in one PHC post in the respective villages, with basic medical equipment.

Most PHC posts have own buildings, provided by SCR or World Concern. In some cases village communities have constructed such buildings on their own initiative and in self-help, a promising tendency.

The Swedish Church Relief has started a well drilling programme for each beel within the context of the PHC programme. This combination has been found to be a prerequisite for success of the programme as the state of health of the population can only be improved in connection with the supply of safe drinking water.

The district PHC teams give advice to the PHC posts and organize campaigns in health education, for example, in questions of hygiene and safe use of water.

Table 1.2/3 shows the number of PHC Posts, PHC Centers and personnel in the Study Area.

Table 1.2/3 Primary Health Care Services and Personnel in the Study Area

District	PHC - Posts	PHC - Center	CHW (1)	TBA (2)
Kismayo	6	1	8	9
Jamaame	6	-	12	12
Jilib	17	1	41	54
Bu'aale	18	-	21	18
Saakow	25	1	26	26
Bardheere	-	-	-	-
Study Area	72	3	108	119
Afmadow	-	-	-	-
Dinsor	-	-	-	-
Luuq		in preparation		

1) Community Health Worker (CHW)
2) Traditional Birth Attendants (TBA)

Source: Own survey (1988)

The PHC programme, although started only in 1982, has already had a considerable impact on the health sector. However, one of the most serious problems still to overcome is the lack of a proper functioning referral hospital in the region.

The success of the programme also depends on the question, whether or not community support on self-help basis can be obtained, particularly in rural areas.

1.2.4 Specialized Health Facilities and Services

In addition to the regular health care and the PHC programme, some specialized health facilities and services exist:

Maternal and Child Health Care (MCH)

This is a national programme of the Ministry of Health, being additionally supported by UNFPA/WHO, initiated with the intention to provide mother and child care, family planning education and vaccination campaigns.

The MCH units are run by the medical staff of the Ministry of Health (MoH) as a complementary task using the existing infrastructure (RH and DH).

Leprosy Center

A Leprosy Center exists near Jilib. It consists of self-help village communities, based on agriculture, for resident patients and their families, treating also outpatients.

The center, serving the whole country, was founded at the turn of the century by a local chief and had been sponsored in the past by the Italian Maltese Aid. Presently, it is being assisted by World Concern with basic medical and supporting staff, equipment, food aid and drugs.

The center comprises central facilities such as laboratory, surgery, pharmacy, stores and (agricultural) machinery with workshop.

Tuberculosis Center

A TBC programme is sponsored by Finnida in Kismayo having started with an 80 bed clinic and an outpatient department. The objective of the programme is to create additional (outpatient) centers for TBC at district and regional level in the Juba Valley, and, subsequently to serve the population at village level through integration into the PHC system.

Malaria/Schistosomiasis Centers

Only one Malaria center exists in Jilib. In the past, several Malaria and Schistosomiasis centers had been sponsored by WHO, but at present the programme is dormant awaiting restructuring.

1.3 Development Concept for Health

The most appropriate concept for Somalia as a large country with low population density and scarce financial resources is an integrative referral health care system with basic services built up from village level, based to a large extent on participation of local communities.

The general "classical" health care system based on a network of District and Regional Hospitals (DH/RH) has a very low impact and cannot fulfill the task of equitable access to health care of all people due to the high investment and maintenance cost and geographical coverage.

Primary Health Care is the only system which is capable of responding to the above-mentioned aspects. Primary health care should cover ultimately and at village level all other formerly established programmes such as Tuberculosis, Malaria, Schistosomiasis control programmes and maternal and child health care. At district and mainly regional level specialized facilities are still necessary.

To improve the health situation of the population in the Study Area, the programme has to consider and to include the following tasks:

- improvement of the nutritional situation of the population
- solution of environmental/domestic hygiene problems
- mitigation of environmental health risks
- maternal and child health care including family planning
- immunization against the major communicable diseases
- health education
- appropriate treatment of common diseases and minor injuries
- provision of essential drugs.

At national level the Primary Health Care Department of the Ministry of Health requires strengthening and will have to take up the coordinating role for all PHC programmes in Somalia. Therefore training courses for high and medium level staff should be implemented.

The Health Education Department in the Ministry of Health (MoH), and also the Curriculum Development Center (CDC) of the Ministry of Education, should develop teaching and training material and audiovisual aids for primary health care; however, both need advisory assistance, financial and material support.

Community participation at village level as a major element of the development concept will have to be raised through increased awareness and motivation of the village population. Community health workers and traditional birth attendants will be recruited from local communities and work after their training on a voluntary basis, supported by the respective communities.

It has to be mentioned here, that primary health care at the present stage cannot fulfill all eight above-mentioned tasks. Therefore it is necessary to evaluate the specific needs of the communities and to decide which of the tasks are the most important ones.

Wherever relevant, the integration of traditional medicine and healers should be considered as important elements in the primary health care system.

In view of the low budget allocation of MoH, it is obvious that primary health programmes could only be implemented with long-term financial support and advisory assistance from donor organizations.

The Primary Health Care Programme has to address the social systems of the two major population subgroups (sedentary and nomadic) differently.

1.3.1 Community Based Primary Health Care for Sedentary Population

The following network of infrastructure and services should be implemented:

- Primary Health Care Posts (PHCP) at village level, serving a population of about 1,000 - 2,000 each, staffed by one community health worker and one traditional birth attendant supported by the village committee

- Primary Health Care Units (PHCU) at Beel level, each serving a population of about 10.000 - 20.000, staffed by one fully trained and one auxiliary nurse, providing technical and logistical support to the related health posts, and offering health care in its own locality

- District Health Centers (DHC), with outpatient and inpatient facilities (max. 15 beds), serving the population in the respective district (30,000 - 50,000), each staffed by one doctor and/or one medical assistant, two midwives, two sanitarians, three nurses, four auxiliary nurses, one laboratory technician and one driver, providing technical and logistical support, as well as training and general guidance to the PHCUs and PHCPs, and taking special care of the patients referred from these smaller units.

Close cooperation between these services is the first condition of a well functioning primary health care system. District and regional PHC coordinators have to fulfill organizational and supervisory functions.

In order to achieve an appropriate standard of provision, the implementation of the following Primary Health Care Posts and Primary Health Care Units will be necessary (see Table 1.3/1).

Table 1.3/1 Required Primary Health Care Posts (PHCP) and Primary Health Care Units (PHCU)

District	1989-1995 PHCP (1)	1989-1995 PHCU (2)	1996-2005 PHCP (1)	1996-2005 PHCU (2)
Kismayo	55	5	111	11
Jamaame	32	3	70	7
Jilib	23	3	116	11
Bu'aale	-	1	18	3
Saakow	-	2	35	4
Bardheere	52	5	105	12
Study Area	162	19	455	48

1) 1 PHCP for 2,000 people
2) 1 PHCU for 20,000 people
3) 1 PHCP for 1,000 people
4) 1 PHCU for 10,000 people

The existing district hospital facilities should be transformed in district health centers with in-patient facilities (15 beds), in Jamaame, Saakow, Afmadow, Bu'aale, Dinsor, and Luuq. In Jilib new construction is necessary because the existing hospital building is unsafe. Considering the particularly high population growth rate in Jilib, the inpatient facility here should be equipped with 25 beds.

The implementation of the PHC programme in Bardheere and Dinsor Districts should be envisaged with priority, because in all other districts of the Study Area such programmes are already in progress. However, all are still far away from sufficient area coverage and need better integration into the sectoral administrative system.

1.3.2 Community Based Primary Health Care for Nomadic Population

For the nomadic part of the population, introduction of PHC programmes will be an innovative element of regional development.

Any new programme will require particularly careful preparation in order to respond to the mobile nomadic way of life and to overcome resulting difficulties for the provision of a reliable health care service. The most appropriate approach should first be tested in a Pilot Project.

Initially, a survey should be undertaken to evaluate the socioeconomic structure, the health attitudes and the pattern of prevalence of diseases of the nomadic society. According to the survey results, a concept for the introduction of PHC should be developed.

The concept would then be introduced to the pilot community and its (newly elected) health committee. The latter will then select CHWs and TBAs from within the community, which would be trained by the next district primary health care center in short-term courses.

The personnel will be supplied with essential drugs and equipment for simple treatment of the most common diseases.

All activities would be supported by the nomadic community and regularly supervised by the regional PHC staff.

1.3.3 Nutrition Pilot Project

In connection with the general PHC programme a special nutrition pilot project should be implemented. It should be based on a concept, that would be developed with the objective to improve the nutritional status of particularly children and women in the reproduction age.

The first step of such a project would be a survey about nutritional habits and food availability which determine the nutritional status of the population. Based on the survey results, strategies for promotion of better nutrition have to be evaluated and tested within the context of the PHC programme.

Teaching material for education in nutrition should be developed for application by PHC personnel, which would require specialized additional training for this task.

The implementation of the pilot project would be monitored, in order to identify the most appropriate concept for further integration in the PHC programme.

1.3.4 Referral Hospitals

For the proper functioning of the PHC system, the availability of referral hospitals are an important condition to provide specialized services in such fields as surgery, gynaecology/maternity, internal medicine and pediatrics.

The Ministry of Health now considers a project for implementation under financing of the African Development Bank for strengthening the health services in the Middle Juba. The planned project would include rehabilitation of the hospital in Kismayo, replacement of the hospitals in Jilib and Bu'aale, strengthening of the planning unit of the Ministry of Health and provision of technical and financial assistance to the Ministry's project implementation unit. Implementation of this project would make a considerable contribution to the improvement of health services and is therefore included as development proposal HEA 3.

However, mainly for equity reasons and taking into account staffing and operating cost coverage capacities, an important modification of these projects is proposed.

Whereas the rehabilitation and extension of the Kismayo hospital is considered justified and necessary, the locations of Jilib and Bu'aale should be reconsidered in favor of Bardheere. In this case, each would serve as a referral unit for either the southern (Kismayo), or the northern (Jilib) part of the Study Area.

In Bardheere, as the capacity and quality of the existing facilities will not be sufficient a new hospital with a capacity of not less than 60 beds is proposed. Apart from the generally marginal service supply situation in the North, the improvement of the hospital capacity there is additionally important because of the expected inflow of people due to the construction of the dam.

Also, the design of the now foreseen hospital facilities appears not to be sufficiently adapted to local conditions (concerning both aspects of tropical design standards and specific requirements of the context of Somalia).

The hospitals have to be understood as an integral link to the PHC approach, and, consequently they have to be developed in parallel with this programme.

The proper functioning of the two referral hospitals will depend upon the availability of qualified staff and regular supply of material and equipment, particularly drugs and laboratory reagents.

Most probably, long term financial support and advisory assistance will be necessary to assure sustained functioning of the hospitals.

2. Education

2.1 Education Level

For an assessment of the status of education in the Juba Valley, it is necessary to consider the educational system in relation to the general educational structure at national level.

Two basic statistical indicators [93] may serve for general reference:

- Illiteracy: Male: 82% (highest world wide)
  Female: 94%

- School Attendance: Male: 28% (lowest in Africa)
  Female: 15% (second lowest in Africa).

These indicators include all parts of the national population. This population, however, has to be differentiated into three major subgroups: the nomadic, the rural settled population and the urban population. No specific indicators are available at national level to characterize each of the above groups individually.

Concerning the nomadic part of the population, only one study [93] has so far been executed which gives a rough indication of the illiteracy level of that part of the population which would be about 88% for men and 99% for women.

As for the Study Area, only the data collected within the JESS Baseline Survey [81] are available for an assessment of the educational level.

The survey, however, concentrated on the rural settled population only (216,000 people, or 43% of the total population and a sample of 1.6%), excluding urban and nomadic parts of the regional population. The survey indicates that "of the Juba Valley population 15 years and older, 36% of males and 15% of females reported ability to read and write Somali. Literacy rates were highest in urban areas where the rate rose to 77% for men and 37% for women. The pastoral sector responded that 10% of men and 3% of women were literate. Regionally, the highest literacy rates were recorded in Lower Juba Region. Lowest regional levels were recorded in primarily pastoral Gedo Region. Women in Juba Valley continue to have lower levels of literacy with less than half that of men."

2.2 Description of the Schooling System

2.2.1 General

The overall responsibility for education lies with the Ministry of Education (MoE).

According to MoE, the formal schooling system includes an eight-year primary course followed by four years of secondary education or two years of vocational training in crafts.

In addition to the basic schooling system, academic education is offered by the National University of Somalia in Mogadishu.

Curriculum development and examinations are centralized in Mogadishu.

The main tasks of the Curriculum Development Center (CDC), which is assisted by various foreign organizations, is to develop textbooks for the different school sections (including environmental and health education). These textbooks are now being introduced into the schools. However, lack of printing and distribution capacities constitutes one of the basic constraints for improving formal education throughout the country.

Attendance in primary schools is free, apart from uniforms and consumables. For secondary education free boarding and lodging is provided.

A general limitation affecting formal and non-formal education is the extremely low budget allocation from Government, which dropped drastically between 1975 and 1987 to some 1.2% of national budget of the Ministry of Education.

Extremely low salary levels for teaching staff of between 600 (primary school teacher) and 1400 SoSh (secondary school teacher) per month result generally (in particular in remote rural areas) in limited motivation of teaching staff, and it implies the need to generate additional income. In addition, a considerable proportion of teachers are recruited from the national service without sufficient professional background, resulting in low-quality standards of teaching.

At regional and district level, education coordinators of the Ministry of Education are placed for general administration, organization and statistics.

Concerning non-formal education, several programmes exist in Somalia. A women's education programme was introduced in 1974 on a voluntary basis with a duration of four years. Also an adult education programme has been established in order to increase literacy levels.

In addition there are about 5,000 Koranic schools in Somalia [94] with some 350,000 children. Each school has a regular attendance of 50-60 children in average. About one-third of the pupils are girls. Koranic and supplementary courses in Islamic studies are taught with the rote-learning and copying method.

In most cases Koranic education is offered in the afternoon in addition to the formal schooling system; in a lot of cases, especially in villages, children are only attending Koranic schools because of traditional habits or because formal primary schools are lacking.

2.2.2 Primary Education

Primary education is divided into an elementary and an intermediate course of four years each. The curriculum consists of general science, mathematics, geography, Somali language, Islamic studies, physical and environmental education. In Grades III and IV, health education, Arabic language and Somali history are introduced in addition.

Table 2.2/1 provides information about the primary school structure in the Study Area.

Table 2.2/1 Primary Schools (Elementary and Intermediate) in the Study Area (1985/86)

District	Schools	Classes	Enrollment Total	Enrollment Female	Teachers	Pupils/ teacher	School- attendance
Kismayo	14	166	5,135	1,828	321	16	23%
Jamaame	27	187	3,704	723	228	16	26%
Jilib	29	161	2,822	783	177	16	20%
Bu'aale	7	39	783	234	49	16	16%
Saakow	11	49	987	177	57	17	13%
Bardheere	9	52	1,062	216	62	17	6%
Study Area	97	654	14,493	3,961	894	16	18%
Somalia	1,201	6,128	189,496	66,753	10,338	18	13%
Afmadow	3	26	517	193	51	10	n/a
Dinsor	10	51	1,105	427	83	13	n/a
Luuq*	10	205	8,701	2,372	362	24	n/a

* including Refugees

Source: [44]

The table shows that some 14,500 students are attending primary schools. The total population in this age bracket is around 78,000 people, which indicates that in the Study Area only 18% of the children of whom one-third are female are actually attending school.

Concerning the pupil per teacher ratio it appears that the situation in the Study Area does not differ greatly from national averages.

Evaluation of the JESS Baseline Survey [81] indicates that pupils who finish the elementary level after four years normally also continue and finish the intermediate course, and that about 85% of the children attending school can read and write.

Table 2.2/2 illustrates the level of school facilities in relation to the total number of population.

Table 2.2/2 Enrollment per District (1985/86)

District	Total (1) Population	Population 6 - 14 yrs	Number of Classes	Popul. in School Age per class
Kismayo	100,600	22,132	166	133
Jamaame	62,500	13,750	187	73
Jilib	61,100	13,442	161	83
Bu'aale	21,500	4,730	39	121
Saakow	34,800	7,656	49	156
Bardheere	74,600	16,412	52	315
Study Area	355,100	78,122	654	119
Somalia	6,500,000	1,430,000	6.128	223
Afmadow	5,400	1,188	26	45
Dinsor	7,400	1,628	51	31
Luuq	19,000	4,180	?	?

Source: [44]

1) Nomads excluded

As can be seen from the above table, the situation of Bardheere District is the most unfavorable one with by far the highest rate of population in school age per available classes.

Taking into account the above-mentioned analysis and additional findings from field investigation, the situation in primary schools in the Study Area can be characterized as follows:

- there are not enough school facilities, particularly in Bardheere and Saakow Districts

- most school buildings in the villages are in poor condition and some are closed

- there are almost no budget allocations for primary school buildings and local authorities are little interested as they have different priorities and, also, limited funds

- a lot of schools are isolated during rainy seasons

- area coverage is insufficient: about 50% of the pupils have to walk more than 5 km to the nearest school

- teaching aids are insufficient

- the curriculum is not sufficiently adapted to the local environment, and subjects of immediate, local importance (e.g. hygiene, health and agriculture) are not taught
- qualified teachers are lacking and little motivated because of low salaries
- families cannot afford to send their children to school because they need their labour force for subsistence activities on farms and otherwise.

2.2.3 Secondary Education

The secondary course of four years is split into two levels, a general (80% of enrollment) and a technical (20%) branch.

The curriculum of the general branch is more sophisticated and includes mathematics, geography, English, science (biology, chemistry, physics), Somali and Arabic languages. The curriculum of the technical branch provides for training in crafts in addition to general courses on the same subjects as the general branch, however, at a lower level.

Secondary schools get certain allocations from the Government and are additionally supported by community contribution.

The structure of existing secondary school facilities is presented in Table 2.2/3. The table shows that 10 secondary schools are located in the Study Area with an attendance of 4.2% of the population in the respective school age, of which about one-third are female.

Table 2.2/3 Secondary Education (1985 and 1987)

Region	Schools	Classes	Enrollment Total	Enrollment Female	Teachers	Pupils per teacher
Lower Juba	5	50	1,655	544	96	17
Middle Juba	2	17	471	128	45	10
Gedo	3	17	567	139	56	10
Study Area	10	84	2,693	811	197	14
Somalia	109	1,051	46,305	16,269	2,801	16

Source: [44]

The ratio of pupils per teacher of 14:1 is nearly in line with the national average (16:1). This indicator, however, has only statistical value, as it reflects the number of recruited teachers rather than the number of teachers actually on the job, particularly in remote locations.

In general, the secondary school facilities are suffering from limitations similar to those of the primary schools, i.e. premises are inadequate and equipment is lacking. The motivation and the qualification of teachers are generally low: a high proportion also being recruited from the national service.

One special case is the secondary school at Dujuma located in Bu'aale District, which also serves Saakow District. This school is placed in a settlement that has a particular administrative status within the Study Area (being under the Settlement Agency) and requires rehabilitation.

Another particular case is the technical secondary school at Luglow in Kismayo District. This school provides full boarding for 650 male students and includes a primary course as well. Being supported by the German Popular High School Federation (Deutscher Volkshochschulverband) it has fairly adequate equipment and premises.

2.2.4 Women's Education

The Women's Education Programme has been introduced in Somalia in 1974, with the overall objective to:

"Provide non-formal education opportunities for rural and urban women, enabling them to contribute more fully in the national development programmes, recognizing that women to a large extent are responsible not only for the physical and social well-being of the family, but also for contributing to the economic resources of the household through agriculture and management of all other available resources" [5].

At national level a Women Education Service was initiated under the Ministry of Education.

Since its creation this organization has progressed rapidly. A Family Life Teacher Training Center was established in Mogadishu, where more than 600 teachers, headmistresses, supervisors and administrators were trained. Simultaneously a network of Family Life Education Centers (FLEC), was set up in almost all of the 82 districts of the country. Four-year family life certificate courses and, lately, also shorter courses, are provided for women and girls.

The subjects include food and nutrition, home management, textiles and clothing, health education, Somali language and mathematics, child care, arts and handicrafts as well as political education.

During the early years, the FLECs generated much interest and were well attended. Upon completion of the 4-year certificate course, many women proceeded to the one-year teacher training in Mogadishu and were subsequently employed by the MoE to teach at their respective district FLEC's. Meanwhile, this employment opportunity has started to fail due to saturation of staffing in FLECs. As a consequence, women have increasingly lost interest, as the real chances to use it for professional careers outside, to allow for increased availability of family income and to improve the general standard of living are minimal. Participation in the programme also had to compete with occupational overburden of women in households including farming, water and firewood procurement.

In 1986, women's education was reorganized and the Women's Education Department (WED) of MoE became responsible. The WED is divided into five Services: Research and Planning, Curriculum Development, Training, Family Education and a Field Service. It started with a new concept in five regions on a pilot basis, assisted by UNICEF and UNESCO. The objective is to raise interest among rural and urban women based on their specific daily needs, particularly to enable them to generate additional family income. The first phase of comprehensive field survey aims at identifying the most appropriate means to achieve the objective.

Some five FLECs are located in the Study Area and the latest statistics of the Ministry of Education (1983/84) indicated an enrollment of 322 students with 31 teachers. However, as has been explained, these institutions are presently awaiting reorganization.

Only in the Lower Juba Region, being one of the above-mentioned pilot regions, does a more dynamic situation prevail.

2.2.5 Adult Education

The adult education was established to increase the literacy level among the population. It started in 1974 in a large nationwide literacy campaign ('Ololaha'). It is combined with the normal school system on a voluntary basis, in evening classes, with a duration of four years.

The curriculum is composed of Somali and Arabic languages, mathematics, science and geography.

Except for Bardheere District, adult education programmes are ongoing in each district (see Table 2.2/4).

Table 2.2/4 Adult Education (1985/86)

Region	Classes	Enrollment Total	Enrollment Female
Lower Juba	24	639	306
Middle Juba	21	687	113
Gedo	12	284	85
Study Area	57	1,610	504
All country	422	10,676	4,909

Source: [44]

In the Study Area about 1600 adults were enrolled in 1985/86, of which one-third were female. However, it appears that, similar to the case of women's education, the interest of the population has been decreasing over the last few years (this statement was confirmed by local authorities during field investigation).

The JESS Baseline Survey indicates that about 3% of the total adult population have participated in adult education (female/male attendance ratio of 1:1.5). Slightly over 50% of them would have reached literacy level.

In addition to the above described evening courses, Regional Literacy and Skill Training Centers were established in seven regional administrative centers to improve particularly maintenance skills. In the Study Area, only in Kismayo does such a center exist.

2.3 Socioeconomic Aspects of Education

In the preceding section, the different components of the educational system in the Study Area have been described and assessed. It can be seen that this system is a rather rudimentary one and faces a number of limitations.

Below, some considerations are presented which aim at illustrating the precarious situation concerning formal education from the viewpoint of the population itself.

Generally, the people live under difficult economic and geographical conditions based mainly on a subsistence socioeconomic structure.

Mainly in primary education, the curricula applied are not adapted to the local environment and the socioeconomic structure of the population. The subjects included, particularly in rural areas are useful only if non-agricultural professional careers are desired. This promotes rural-urban migration.

Direct consequences for education are caused by a rather serious labour force conflict at household level, where the labour force of children in school age is needed within the subsistence economy of families at various levels:

- children are used in farming activities for field work, animal herding and transport
- children contribute to various household activities such as firewood and water collection
- children, particularly in urban areas, are working in small-scale trade and other secondary sector activities for additional family cash income; the same applies in rural areas of the southern districts of the Study Area, where children are working in estates (for example banana packing).

Finally, mobility constitutes another serious constraint: as the rural population, at least to some proportion is forced to migrate as a consequence of seasonal farming practices, continuity in school attendance is not practicable in a number of cases.

In principle, the same limitations apply for adult and women's education. Particularly, the aforementioned conflicts in labour force allocation can be mentioned here. Another similarity involves curricula which do not offer solutions in line with the needs of the population concerned.

2.4 Development Concept for Education

It becomes obvious, that the formal and non-formal education systems in the Study Area suffer from many limitations which are comparable throughout Somalia.

To achieve an improvement of the educational level of the population, education has to be brought closer to the people and be adjusted to the social structure allowing the population to effectively utilize it. This calls for a concept which would promote development from the "grass roots".

The main tasks of such a development concept are:

- increase/improvement of facilities (rehabilitation and construction of school buildings)

- provision of sufficient equipment and teaching materials (appropriate textbooks have already been developed, but printing and distribution is presently hampering their application in the field)

- motivation and training of teachers; because of the low salaries of teachers, additional support particularly from the communities is necessary, e.g. provision of houses, incentives in kind and access to subsistence farmland. Teacher refresher courses will be needed to update the knowledge of teachers in the different subjects and didactics

- reorientation of the curriculum to include health, hygiene, environmental and agricultural components

- promotion of community participation in the organization of schools and education programmes. This could materialize particularly through assistance in construction, maintenance of school facilities and support to teachers

- permanent monitoring of programmes in each education system in order to improve the efficiency of the different development programmes.

With regard to the order of magnitude of required investment, one means of cost reduction would be to combine the use of facilities ("Tuulo School Concept") in different education systems; another element would be to achieve active participation of local communities in construction and maintenance.

For both the formal and non-formal education systems, quite a number of appropriate development concepts exist. However, their implementation requires additional support.

2.5 Formal Education

2.5.1 Primary Education (Elementary and Intermediate)

Strengthening of the primary education system is particularly important within the general development concept for education. Starting at village level, a programme should be implemented to provide the essential elements for making qualified primary education accessible to all children of school age. The concept should allow for the integration of primary school education into the social structure, permitting the participation of children in subsistence activities of their families. One possibility to achieve this could be to adapt the school year to the cropping calendar.

In view of the various limitations of the present situation, this objective could only be reached in several steps and with considerable effort. A concept concerning such a programme exist, however, resources for its implementation are still lacking.

In the following, the main tasks of the programme are outlined.

- Construction and Rehabilitation of Primary School Buildings:

  In view of the bad conditions of most primary school buildings, rehabilitation and construction of facilities have to be undertaken in different steps and gradually according to available resources.

  The rehabilitation of the existing facilities should have priority. A specific study would have to be undertaken to evaluate the condition of primary school buildings in the Study Area.

  For urban areas the following approximate number of school classes would have to be made available until 2005 (see Table 2.5/1).

Table 2.5/1 Primary School Classes (Elementary and Intermediate)

Districts	1989--------1995 (1) classes	1996--------2005 (2) classes
Kismayo	36	282
Jamaame	-	31
Jilib	14	186
Bu'aale	-	10
Saakow	-	36
Bardheere	23	178
Study Area	73	723
Afmadow	10	4
Dinsor	-	18
Luuq	11	54

1) pupil per class ratio 1989-1995: 45; attendance rate 1989-1995: 40%
2) pupil per class ratio 1995-2005: 40; attendance rate 1995-2005: 60%

For rural areas, in the first phase from 1989 until 1995, primary schools have to be constructed or rehabilitated in each beel of the different districts, which would imply approximately 80 schools.

The objective for the second phase, from 1996 until 2005, is the implementation of primary schools in each primary and secondary village, which would concern the construction or rehabilitation of approximately an additional 150 schools until 2005.

- Teacher Training and Motivation

The curriculum of teacher training in primary schools should include environmental, hygiene, agricultural and health education subjects. Teachers have to be trained in didactics to enable them to impart this knowledge to the people in such a way, that they could use it in their daily lives.

Primary school teachers should be trained additionally in the specific didactics for adult education.

Refresher courses should be implemented at regional level, supported by the Government and assisted by the Curriculum Development Center.

Concerning the low salaries of teachers, different support concepts should be developed, considering community participation to provide houses and incentives in kind. Additional income opportunities e.g. in farming should be made possible.

- Equipment and Teaching Material Supply

Concerning the fact, that most Primary Schools have none or insufficient equipment, the initial provision of basic material and equipment for each Primary School in the Study Area should be foreseen including sustained regular supply according to needs. This could only be envisaged in several steps and should be linked to the construction or rehabilitation of schools.

Appropriate teaching material (textbooks) and aids have already been developed, but the Curriculum Development Center needs support in printing and distribution. As the distribution of textbooks to all primary schools cannot be executed in one step, availability in schools could be built up gradually. A staff unit should be established in the Curriculum Development Center to be responsible for the distribution.

- Management Staff Training

In order to be able to cope with the necessary development programmes, the Primary Education Department of the Ministry of Education requires strengthening. This aspect concerns the improvement of managerial and technical skills at central level for efficient sectoral development guidance.

2.5.2 Secondary Education

Secondary Education is geared towards the provision of higher and more sophisticated general education in preparation for academic studies at the National University in Mogadishu. It may, however, have a certain tendency to promote rural-urban migration and migration out of the region, particularly when job opportunities and incentives within the region are lacking. With regards to the need of the region for improved skills, a general improvement of secondary schools should be considered. In addition, more technical courses should be introduced to prepare students for intermediate-level technical skills.

In principle, development of secondary education follows the same objectives as primary education. However, the following tasks are important in addition:

- inventory of existing facilities and determination of development requirements

- development of specific curricula for the technical branches

- provision of equipment for technical branches

- provision of boarding and lodging facilities and services for students

- specialized teacher training.

In each district of the Study Area secondary school buildings exist. Priority should be given to rehabilitation and upgrading of these facilities, before considering new construction. Until 1995, the existing facilities will be sufficient.

After that time (in a first phase), the rehabilitation of one secondary school in each major urban center (Bardheere, Jilib and Kismayo) should be considered, which also includes the (additional) provision of boarding and lodging facilities.

In a second phase the secondary schools in Dinsor, Luuq, Dujuma, Afmadow and Jamaame should be rehabilitated.

2.5.3 Vocational Training

The implementation of a Vocational Training Center as an inter-regional facility for southern Somalia would be an important element to provide technical skills required in industry, manufacturing and crafts. There is a high and ever increasing demand for skilled technicians, particularly for maintenance in the Study Area (which has suffered in the past from a drain of technicians and craftsmen taking up better paid jobs in the capital and the Gulf States).

It is suggested to establish such a facility in Jilib because of the central location of this urban growth pole and the particularly high concentration of industrial and manufacturing enterprises in the southern part of the Study Area.

Teacher training should be particularly adapted to the specific needs of the Study Area and should be undertaken in close cooperation with the Ministry of Industries.

2.6 Non-Formal Education

2.6.1 Women's Education

Women are playing an important role in the development of Somalia, they have to cover a wide range of domestic and economic activities. Women's education programmes should therefore primarily be geared towards assisting women to reduce the occupational overburden and to create diversified alternative occupation opportunities.

To improve women's education, it would be necessary, first to assess the needs of women in their specific environment and to develop curricula for adapted courses, that would help them to make better use of their labour force and provide them with skills that would allow them to generate additional family income.

These development principles are applied in the national Family Life Education Programme which is being implemented presently in five regions of Somalia. In the Study Area, only Lower Juba Region is included in this programme so far. The basic development concept for women's education is to strengthen this ongoing programme, including assistance to the Women Education Department (WED) in Mogadishu to achieve full coverage of all regions in the Study Area.

The programme would require the following:

Every regional center should be equipped with one Regional Family Life Education Center (RFLEC). These RFLECs should fulfill the following tasks:

- research of the specific needs of women in the particular region
- planning and coordination of the different courses in the region
- training of district women education teachers
- development of curricula, teaching materials and aids
- implementation of skill and craft training courses and short courses in home management, agriculture, child care, food and nutrition, Somali language, textile and clothing.

At each district center, one District Family Life Education Center (DFLEC) should be provided to fulfill the following tasks:

- evaluation of the needs of women in their specific environment
- execution of short training courses for Community Women Leaders, who will be assisted to generate community improvement and additional income generating activities upon return to their villages

- development of specific courses for the villages, including teaching aids

- implementation of short courses in home management, agriculture, child care, food and nutrition, Somali language, textile and clothing.

In primary villages, Satellite Family Life Education courses should be established with the task to implement specific courses for women in their village environment. These courses will be offered by Community Women Leaders, selected by the village committees. All these activities should be supported by the respective communities, supervision will be organized through the Regional Family Life Education Coordinators.

The programme should also include the construction and rehabilitation of appropriate buildings.

In the Study Area those districts should have priority, which are not yet included in the programme (Bardheere, Saakow, Bu'aale and Jilib).

2.6.2 Adult Education

Adult Education programmes have the basic objective to improve the general literacy of the population in a wider sense. They should start at village level and have to consider the following main tasks:

- to make communities aware of environmental issues

- to offer training courses for simple technical skills

- to enable people to make optimal use of social infrastructure and services.

The existing adult evening courses, which offer three years basic education roughly equivalent to primary education and the Regional Adult Literacy and Skill Training Centers should be strengthened in all districts, however, with priority for Bardheere District, where so far no adult education programmes had been implemented.

Adult evening courses should be integrated into existing primary school facilities and services. Also school gardens can be used for demonstration of improved crop production techniques to adults and children. Health education can be offered in cooperation with the community health workers of the primary health care programme in the villages in order to improve people's awareness concerning health issues.

Regional Adult Literacy and Skill Training Centers should be established in each regional center, with the exception of Kismayo, where such a center exists already.

ANNEX 13

S O M A L I A

Masterplan for Juba Valley Development

Disease and Disease Vector Control Programme

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ANNEX 13

List of Abbreviations

AMREF	-	African Medical and Research Foundation
CISP	-	Comitato Internazionale per lo Sviluppo dei Popolo
PHC	-	Primary Health Care

Disease and Disease Vector Control Programme

Summary

A broad spectrum of diseases is found in the Juba Valley. As in other developing countries with a similar ecological and socioeconomic situation there are mainly upper and lower respiratory infections, diarrhoeal diseases, intestinal parasitic affections, malaria, schistosomiasis (urinary form), skin diseases, malnutrition etc. Some of these diseases have high fatality rates, contributing to very high infant mortality rates and low life expectancy.

With the expansion of irrigation and agriculture and the construction of the Bardheere Dam, water-related diseases like malaria, schistosomiasis and diarrhoeal diseases will increase in the lake area as well as downstream of the dam. To mitigate these, an integrated disease and vector control programme in close cooperation with the health sector and other services such as agriculture, irrigation, fishery, forestry, settlement planning etc. will be of paramount importance for further development of the Juba Valley.

Right from the beginning, the communities themselves should be involved and should contribute to the programme as much as possible. Without their support the programme will fail.

Experience with an integrated disease and vector control programme does not exist in Somalia. Therefore a action-oriented research pilot programme should be implemented in which packages with different control methods should be tested. After identification of the most effective packages these should be implemented in a larger scale in other areas.

Regular inspections of the dam spillway and suitable snail habitats must be made because of the possibility of introduction of black flies and the intermediate snail host for intestinal bilharzia.

Advisory support of two long-term experts with experience in vector habitat ecology and management of integrated disease and vector control will be necessary. Because of serious local budget constraints, investment and running costs of the control programme have to be included in the external financing of the dam.

1. Major Diseases and Vectors Existing in the Juba Valley and Possible New Introductions of Diseases

Several small-scale surveys during the last decade and own interviews with the district health personnel give a rough estimate about the most important diseases in the Juba Valley. These are mainly:

- Diarrheal diseases, intestinal parasitic diseases
- Upper and lower respiratory infections (Tuberculosis included)
- Malaria
- Schistosomiasis
- Skin diseases
- Malnutrition
- Eye infections
- Veneral diseases.

Besides these, many other diseases are certainly present in Somalia and in the Juba Valley but are rarely mentioned. In many instances, diagnosis is only possible with good working diagnostic facilities, but in the country in general and particularly in the Juba Valley these are lacking: leptispiosis, arthroborne virus diseases, hepatitis A and B, brucellosis, anthrax, tetanus, whooping cough, measles, rabies, hydatid disease, visceral leishmaniasis, cardiovascular diseases, cancers, accidents etc.

High case fatality rates of many of these diseases contribute to the very poor health; e.g. infant mortality about 150 per thousand, which is one of the highest world wide.

With extension of irrigated agriculture the importance of diseases and vectors related to water will further increase.

The most important diseases related to water and agriculture are the following:

1.1 Malaria

According to the National Antimalaria Service, the dominant species of malaria parasites in southern Somalia is Plasmodium falciparum and its principle vector Anopheles arabiensis (formerly called Anopheles gambiae), closely followed by Anopheles funestus [104, 126]. Transmission occurs throughout the year, but reaches highest levels at the end of the rainy seasons and the beginning of the dry seasons (see Table 1.1/1).

In a survey conducted by Swedish Church Relief in 1983 [89] nearly 100% of the interviewed persons acknowledged having suffered from an attack of Malaria (interviewee - felt diagnosis, no defined recall period). In the lower Juba Valley parasitic and spleen rates in children are in some villages up to about 50% (see Table 1.1/2 and [111]).

Table 1.1/1 Monthly Blood-Slide Positivity Rates for Malaria in Somalia Reported from Government Hospitals and Laboratories, 1985 [116]

Month	Slides examined	Positive for Malaria in %
January	4,157	9.67
February	3,485	5.91
March	3,300	4.97
April	4,046	3.24
May	4,530	4.42
June	4,351	9.42
July	4,289	13.29
August	4,591	9.69
September	4,131	7.99
October	4,059	3.82
November	4,013	3.61
December	1,303	10.74
Total	46,255	7.13

Table 1.1/2 Spleen and Parasite Rates in the Different Villages in Children Aged 2 - 9 Years from the Lower Juba Region [111]

Village	Total Number	Spleen Rate %	Parasite Rate %
Buulo Maamow	67	52.2	50.7
Beled Amiin	160	26.5	32.5
Malaayleey	83	20.0	35.0
Moofa	137	19.7	32.1
Beled Raxma	168	16.7	21.4
Mana Moofa	99	16.2	19.2
Nafta Quur	62	3.4	5.1
Jamaame	121	1.7	3.0
Bangeeni	117	1.7	8.3
Janaale Jaay	232	1.6	12.9

1.2 Schistosomiasis (Bilharzia)

Only the urinary form of bilharzia (Schistosoma haematobium) is found in the southern part of Somalia (Juba and Shebelli Valley). Its intermediate host is Bulinus abyssinicus, a small snail, highly resistent to desication. The snails are found in stagnant pools and irrigation schemes (rice fields, drains, irrigation canals), but not in the Juba River (water velocity and turbidity are too high). Bilharzia prevalence is closely related to frequency of contact with snail-infested surface water. Several small-scale surveys carried out in the Juba Valley came up with very high prevalence rates of bilharzia, often close to 100% (see Tables 1.2/1 and 1.2/2, and [89, 104, 109, 127]). Egg outputs are highest among children between about four and fourteen years of age.

Table 1.2/1 Prevalence of Urinary Bilharzia Among 5 - 14 Year-old Children in Villages and Town of Jamaame District [109]

Village	Children Examined	Children Infected	Prevalence of Bilharzia in %
Sabatuuni	55	54	98
Bandar Jadiid	125	118	94
Dheymo and Turdho	202	102	90
Nyireey	110	99	90
Bardheere Yareey	101	87	86
Kobon	275	234	85
Beled Aamiin	148	123	83
Maana Muufa	120	88	73
Kamsuma	175	126	72
Buulo Maamow	61	43	70
Beled Raxman	108	75	69
Janaale Jaay	44	30	68
Bangeeni	74	49	66
Above Villages	1,598	1,308	82
Jamaame Town	404	186	46
Grand Total	2,002	1,494	75

Table 1.2/2 Prevalence of Urinary Bilharzia in Juba Valley of Somalia in 1971 [127]

District	Village	Persons examined	Prevalence in %
Kismayo	Buulo Guduud	108	79
Jilib	Homboy	105	89
Bardheere	Saakow	109	25
Bardheere	Doblei	109	51

Occasional cases of intestinal bilharzia (Schistosoma mansoni) and its intermediate host snail, Biomphalaria pfeifferi were found in the North of Somalia. The intestinal form is also found in North Central Kenya as well as in the upper watershed of the Juba Valley in Ethiopia. Up to now Biomphalaria pfeifferi has not yet colonized the lower Juba Valley, probably due to the long dry seasons which make it difficult to survive. However, with increasing irrigation schemes where water will be available throughout the year, there is a possibility that the snail will also settle in the lower Juba Valley, washed down in the river from Ethiopia or brought in by birds from Ethiopia, Northern Somalia and Kenya [104, 126].

Presence of the snail and immigration of people with intestinal bilharzia would then start transmission. Then, the more severe form of the intestinal bilharzia would be found in the Juba Valley.

1.3 Arbovirus Diseases

There is no assessment about these virus diseases, transmitted by various kinds of mosquitoes. Dengue fever is said to occur throughout southern Somalia. Yellow fever has not yet been reported but constitutes a threat. Other viral infections that appeared in epidemics in East Africa include Chikungunya, O'Nyong-Nyong, West Nile and Rift Valley fevers. Increased mosquito breeding as a consequence of perennially available surface water will increase its risk.

1.4 Diarrhoeal Diseases

Most of the spells of diarrhoea in developing countries occur in childhood with high mortality rates. Causes of diarrhoea are manifold and have never been investigated epidemiologically in the Juba Valley. Causes may be viruses (rota, poliomyelitis, infectious hepatitis, measles etc.), bacteria (typhoid, paratyphoid fevers, cholera, caapylobacter shigella etc.), protozoa (amibes, giardia etc.) or corn worms (ascaris, pinworms). Many of those infectious agents are transmitted by water. Beside high incidence rates throughout the year, diarrheal epidemics occur regularly every year at the end of the dry seasons and at the beginning of the rainy seasons caused by reduced and more contaminated water bodies. The first rains wash in surrounding fecal contamination and high turbid water consequently blocks the purification effect of the sunlight.

1.5 Worm Infections

Among the sedentary population prevalence rates of worm infections (ascaris, pinworm, hookworm etc.) are very high (Swedish Church Relief survey: +/- 80%, interviewee felt diagnosis, no defined recall period). Among the work force in banana plantations Ancylostoma duodenale is prevalent to nearly 100%, whereas in nomads it is nearly nonexistent [104]. The moist clay soils needed for banana cultivation are ideal for transmission of hookworms.

1.6 Malnutrition

Malnutrition is widespread in the Juba Valley, probably somewhat more in the middle and upper regions. It is caused by insufficient food intake (poor food habits, scarcity of food) and frequent spells of infections, both often leading to a vicious circle. Large-scale monocultures or cash crops lead to scarcity of locally available adequate and varied food which is necessary for a balanced diet. Low salaries of the agricultural work force who do not have the possibility to grow their own additional food worsen the situation. During planting and harvesting seasons both parents spend long hours in the fields and thus neglect the smaller children.

1.7 Potential New Disease Introductions

As already mentioned there is a possibility of introduction of the intestinal bilharzia and several arthropode-borne virus diseases in the Juba Valley. Another new introduction of disease, the river blindness (Onchocerciasis) could occur if certain species of black flies which transmit the disease would settle in the Juba Valley [104, 126]. The flies require high velocity water flow for breeding. At present there are very few suitable sites in the river, including the spillway of the Fanoole Dam. The spillway of the proposed dam near Bardheere could create another ideal breeding place for black flies. There are sources of black flies in the Shebelli valley, in Ethiopia, Kenya and North Yemen. It is known that black flies may be drifted by winds several hundred kilometers. After a possible invasion of black flies, to start the disease, immigrants infected with onchocerciasis have to come to the valley, too.

Excessive use of biocides, mainly from large-scale farms will increase the risk of serious health and ecological hazards especially at the Lower Juba Region where high concentration of biocides will appear in the water. Accidental poisoning with biocides will also occur.

2. Limiting Factors for Disease and Disease Vector Control in the Juba Valley

Because of the complex origin of diseases and disease vectors, the control of these should be tackled in an integrated way. In Somalia this has been done only to a negligible extent. Therefore, no experience with this kind of strategy is available.

In the past, low emphasis was put on preventing diseases. The health sector concentrated on passive curative treatment which is expensive and ineffective. Moreover, the health sector is seriously underfinanced (1987: 1.3% of the governmental budget was allocated to the health sector) which leads to low efficiency of its services. Health personnel is poorly paid and trained, health facilities are in a very poor condition, drugs in the public services are rarely available. The national Malaria Programme shows little activities; the Schistosomiasis Control Programme was stopped in 1986. Health and vector control has very low political priority.

With support of NGOs, multinational and Government agencies such as UNICEF, Swedish Church Relief, World Concern, AMREF and CISP as well as UNCOR in refugee camps preventive measures just started in most of the districts (not yet in Bardheere, Dinsor and Afmadow). These encouraging community action programmes comprise the organization of urban and rural residents to educate themselves with support of public services and the pooling of resources for improved health and sanitation facilities. However, a total coverage of the Study Area by this community-based Primary Health Care (PHC) Programme not yet reached.

Research in disease and vector control has rarely been done. Cooperation to reduce disease vectors of malaria and schistosomiasis services of the Ministries of Agriculture, Fisheries, Forestry and Range, Public Works, Education etc. on the one hand and the communities on the other hand have been negligible. Several years ago a few preliminary field studies were carried out outside the Study Area using indigenous fish for elimination of mosquito larvae from water reservoirs. Experience on a larger scale has not been gained.

In 1986 a chloroquine resistent strain of *Plasmodium falciparum* appeared and seems to spread rapidly throughout southern Somalia. In future more expensive drugs with side effects will have to be used for malaria treatment, a heavy burden for the country with its scarce foreign currency resources.

Proper community water supplies rarely exist. Most of the rural and even urban communities use untreated surface water. Pumps or generators of water supply facilities are often broken down, fuel for the generators lacking and chemicals for water treatment not available. Apart from the refugee camps, no adapted technologies for water purification as e.g. slow sand filters have been introduced to the Juba Valley.

Water sources are often used by both people and animals which increases the chance to attract livestock diseases.

Most of the people do not have latrines. The few existing ones are poorly designed and rarely used, especially not by children who spread most of the fecal-borne diseases.

Poor road infrastructure and flooding of many roads during the rainy season make control activities very difficult.

3. General Concept for Disease and Disease Vector Control in the Juba Valley

Prevention of the annual floods after the construction of the Bardheere Dam will lead to a certain reduction of mosquitoes and consequently of Malaria downstream of the dam.

However, further expansion of irrigated agriculture with or without construction of the Bardheere Dam will lead to an increase of availability of slow flowing water. This will increase and spread to other areas the already existing high prevalent water-related diseases, mainly malaria along with mosquito-borne virus diseases and schistosomiasis. A larger work force, needed for agriculture, will further increase contamination of surface water with consequent increase of diarrhoea and intestinal parasite affections.

To alleviate existing and increasing health problems which will come along with expansion of agriculture, irrigation and the construction of the Bardheere Dam, special emphasis must be put on a control programme for diarrhoea, malaria and schistosomiasis and their vectors/intermediate hosts.

Because of the complex origin and stages of these diseases and their vectors, the health sector itself cannot tackle the programme alone. There is an urgent need for an inter-sectoral approach involving the following sectors: health, agriculture, irrigation, fishery, forestry, rural and urban settlement planning, public works, education etc. In addition, the communities themselves [133, 134, 135, 136, 137] stirred by the MJVD.

The Ministry of Health in close cooperation with other ministries should elaborate guidelines which have to be considered in their activities to reduce vector habitats and vectors. The health sector itself has to carry out additional activities and monitor the effectiveness of the programme. Additionally to these proposals regular inspections of the spillway areas of Fanoole and Bardheere Dam for black flies have to be carried out. Inspections of snail habitats for the intermediate snail host of intestinal schistosomiasis have to be carried out to detect these vectors as soon as possible to be able to take measures against them at a very early stage.

The work force coming from infested areas with intestinal bilharzia (North Somalia, Kenya, Ethiopia) should be screened for Schistosomiasis mansomi. This will especially concern labourers at the Bardheere Dam.

4. Disease and Vector Control Measures

Environmental management for disease vector control would be the most cost-effective method for reducing mosquito and snail habitats in existing and new irrigation systems. Proper design of canals, irrigation structures, fields and drains will minimize vector habitats. Depressions in or near settlements should be filled or drained or planted with trees such as eucalyptus which absorb large amounts of water from lowlands.

Selection of crop rotations which allow periodic drying of canals and fields would also be an efficient method of mosquito and snail control. Two rice crops in sequence should be avoided because this would create ideal mosquito and snail habitats. Even single rice crops create favorite mosquito and snail habitats, but crop rotation and repeated water drainage at intervals could considerably reduce them.

Frequent maintenance of canals, drains and irrigation structures, especially removal of sediment and aquatic vegetation, is an important method of reducing overbanking of canals and subsequent flooding of lowlands; a prime source of mosquito and snail habitats.

Biological control of malaria should also be introduced. Local varieties of larvivorous fish (e.g. Orcochromis spiluris, Orcochromis nilocticus, Notabrachius etc.) should be raised in fish hatcheries on a large scale and inserted in stagnant water ponds as well as in irrigation schemes. This would not only reduce mosquito larvae but would bring along an additional protein source.

Exploiting inter-molluscan competition and introduction of bacterial agents could also be used, as could other methods.

Chemical methods could also be considered as a supplement for mosquito and snail control (e.g. indoor spraying, focal molluscociding).

Rehabilitation and expansion of existing or introduction of new adapted water supply systems (e.g. slow sand filter), preferably wells in rural areas will be a minimum requirement for health protection.

Intermittent mass treatment of the population with Praziquartel or at least of children of about four to fifteen years of age who have the highest schistosoma egg output, would be an additional method to reduce transmission of schistosomiasis.

Promotion of homemade sugar and salt solutions as "treatment" against diarrhoea would reduce fatality rates considerably.

Health education and community participation in all those activities mentioned above is of paramount importance. The community must be involved from the beginning in this multi-sectoral strategy and contribute its own resources.

Strategies have to be elaborated on how control methods can be incorporated in ongoing programmes such as the Primary Health Care Programme with promotion and mobilization of community participation which would allow that, as much as possible, complete or partial responsibilities for operations carried out at the beginning by specialized bodies could be taken over by the community and multipurpose PHC workers. But small specialized units at higher level will still be needed to support activities at the grass roots level.

Avoiding human contact with snail infested water from midday to sundown where risk of infection is greatest would reduce the transmission. This precaution is not only very important for agricultural and irrigation labourers, but also for the entire population.

High political priority for disease and vector control is of paramount importance or even <u>the</u> precondition for the success of a the proposed control programme.

5. Proposal for a Disease and Disease Vector Control Programme

The various briefly mentioned control methods cannot be introduced at once in all the regions of the Juba Valley. Sector specific guidelines and packages of these have to be formulated, intensively discussed with the services involved and the communities, tested, refined and the most cost-effective ones defined in an action-oriented research approach in a pilot project. The pilot project should mainly concentrate on one district, preferably the Jilib/Fanoole area. This region, already well advanced in irrigation and agriculture, will be further developed and would thus be an ideal area where strategies could be tested. Moreover, many places are accessible throughout the year and Kismayo with its infrastructure facilities would not be too far away. Road connections throughout the year to the capital Mogadishu are assured, too. Bardheere District could be another suitable pilot project area.

The tasks outlined above would require advisory support of two long-term consultants with experience in vector habitats, ecology, vector assessment and management of integrated disease and vector control, one for malaria and one for schistosomiasis and diarrhoeal diseases. A short-term consultancy for about two months should precede their long-term mission to get an insight into the present situation and the existing equipment and personnel of the presently halted or low-active schistosomiasis and malaria services. Based on the findings, a policy has to be formulated and agreed upon and estimates for budget and equipment, drugs, pesticides, moluscocides requirements and other quantifiable inputs made. About 6 - 9 months later the pilot programme (Figure 5/1) could start with surveys to get baseline data about prevalence/incidence of the diseases, vector habitats and prevalence of vectors taking into consideration dry and rainy seasons, socioeconomic and cultural patterns that influence disease and vector control. Preferably local social scientists, community motivators and organizers should be called in to support these surveys and the following planning and implementation of community interventions. Close cooperation with various branches of the University of Mogadishu should be aimed at during the pilot phase. These could cover several aspects in research e.g. dissertations for senior students and junior staff. It is this institution which will produce the next generation of decision makers, and their commitment to the integrated approach is vital.

During the pilot phase, surveys about prevalence/incidence of the diseases, vectors and vector habitats in other districts have to be carried out to get baseline data which are necessary for the extension of the programme at a later stage.

After identification of the most effective low-cost strategies during the pilot phase, these can be introduced step by step on a larger scale to other districts in the Juba Valley.

Figure 5/1 Time Table

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6 onwards
Short-term consultancy for preparation	—						
Order of project equipment		—					
Field organization setup		—					
Surveys about incidence, prevalence of diseases, disease vector habitats, vector habitats, disease vectors, socioeconomic situation, habits etc.		—	—				
Design of integrated disease and disease vector pilot programme			—				
Implementation of pilot programme			—	———	———		
Monitoring diseases, vectors, activities etc.			—	— —	- - —		
Identification of the most effective combination of control measures					- —		
Design for expansion of the control programme to other areas						—	
Expansion of the control programme to other areas						—	———
Regular inspection of suitable habitats for black flies and Biomphalaria pfeifferi			—	— —	— —	— —	———

ANNEX 14

S O M A L I A

Masterplan for Juba Valley Development

Environmental Management in Juba Valley

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List of Abbreviations

EC	-	Electric Conductivity
EEC	-	European Economic Communities
EIA	-	Environmental Impact Assessment
IEE	-	Initial Environmental Examination
JESS	-	Juba Environmental & Socioeconomic Studies
MJVD	-	Ministry of Juba Valley Development
MoH	-	Ministry of Health
NRA	-	National Range Agency
UNEP	-	United Nations Environment Programme

Environmental Management in Juba Valley

1. Introduction

In 1972 the international UN Conference on the Environment in Stockholm recognized the need to harmonize development and environment. A few years ago UNEP (United Nations Environment Programme) conducted an investigation in order to assess the progress achieved since then. The results were rather disappointing: while most developing countries have enacted environmental legislation and established responsible institutions, environmental quality world wide declined, natural resources are exploited at ever increasing rates and large population groups are affected by environmental disasters. Environmentally sound development is needed more than ever.

When one replaces "environment" by the term "natural basis of existence", the importance of this issue for Somalia's development becomes immediately clear. Livestock, agricultural production and thus exports, economic development and the welfare of the people are directly dependent on nature and its use and management. Harmonizing development and environment, therefore, must be a major development objective for Somalia in general and for the Juba Valley in particular.

Integrated environmental management is a multipurpose task, requiring coordinated efforts of various governmental institutions as well as concerned people and their representatives. Without doubt, the Bardheere Dam Project will drastically change the environmental conditions in Juba Valley. While the development potential particularly in the agricultural sector will be substantially enhanced, the dam project might entail adverse environmental impacts severely affecting nature as well as people of Juba Valley. Environmental management has to address those adverse impacts and to provide appropriate solutions.

However, environmental management should not be limited to only counteract negative environmental impacts caused by the Bardheere Dam Project. Even at present severe environmental problems and signs of ecological degradation are apparent, calling for appropriate plans and actions in order to prevent further deterioration and to enhance environmental conditions.

This ANNEX provides a framework for environmental management in the development of the Juba Valley, environmental management understood as the management of the natural resources on a sustainable basis, the minimisation of adverse impacts caused by development activities and the enhancement of pollution and ecological degradation. Presented findings, conclusions and recommendations are mainly based on the work of the JESS Project which has greatly contributed to improve the knowledge of existing environmental conditions in the Juba Valley and to identify and highlight the implications of the Bardheere Dam Project.

The main purpose of this ANNEX is:

- to assess the present environmental situation in the Juba Valley
- to identify adverse environmental impacts caused by the Bardheere Dam Project
- to outline mitigating measures needed to remedy them
- to identify institutional requirements, and
- to outline programmes and projects for implementation.

It should be noted here that this ANNEX is no substitute for a full scale Environment Impact Assessment and that the implementation of many projects will require more intensive analysis.

2. The Environment of Juba Valley

Somalia's environment is a harsh environment. Temperatures and evaporation are high, rainfalls low but often devastating and irregularly distributed over time and space, surface and groundwater resources are limited and often too saline for consumption, disease vectors prevalent in many areas. Health and welfare of the people are severely affected by the environmental conditions and some problems call for solutions even in the without-dam situation.

Environment is understood as the total surrounding of man including physical, biological, social and economic factors of influence. In accordance with Principle 2 of the Stockholm Declaration on Environment, environmental protection or management refers to "the natural resources of earth, including air, water, land, flora and fauna and especially representative samples of natural ecosystems." Environmental protection therefore deals with:

- atmosphere (air quality, climate, noise etc.)
- hydrosphere (surface water, groundwater)
- land (soils, minerals etc.)
- biosphere (flora, fauna, biomass).

2.1 Atmosphere

Air pollution is not considered as a problem in the Juba Valley. There are only few industrial sources of air pollution for example the sugar factory of the Juba Sugar Project and their emissions are limited. Adverse effects have not been reported. Due to the limited vehicular traffic vehicular emissions are likewise low. Domestic emissions of fireplaces are not considered as a health risk compared with other prevalent health risks.

Like in many other coastal areas the air along Somalia's coastline is rather corrosive. This is caused by sea spray which is generated by the surf and wind. Structures, not properly protected by appropriate coatings might be affected thus shortening their life span. No figures of damage caused by corrosion are known.

2.2 Hydrosphere

Most of the pressing environmental issues in Juba Valley are related to water, its availability, its quality and its function as habitat. The hydrologic section of the Masterplan clearly pinpoints water as the most limited resource compared to land or biomass. There is more suitable land for irrigation available than water to irrigate it even with Bardheere Dam.

This Section deals with the physical and chemical aspects of water resources (availability, quantity, quality) while the role of water as habitat, for example of disease vectors is discussed below in Section 3.4.

The Juba River is the most important surface water source. For nine months of the year the river provides sufficient water to irrigate all lands. Only during Jilaal season demand exceeds supply. The shortage is felt in the lower reach. The large state-owned irrigation projects, in particular the Juba Sugar Project, are forced to restrict irrigation pumping and the banana plantations incur reduced production. The drastic increase of small-scale irrigation pumping in the upper reach has apparently aggravated this seasonal shortage: total dry periods in the lower reach are experienced more frequently.

Low flows (less than 15 m^3/s) leads to saltwater intrusion reaching as far as 45 km upstream of the estuary. This affects the water supply of Kismayo. The intake of the water plant is situated at Yontoy, 30 km upstream from the estuary. The use of undiluted seawater for domestic purposes causes severe gastroenteritic diseases during that period. Adversely affected by saltwater intrusion are also the banana plantations.

Other surface water bodies include the temporary or permanent swamps of the Lower Shebelli and desheks. They are an important habitat for wildlife, are used for livestock watering and for agriculture (see Section 2.4). Construction of the Fanoole canal and the Jilib - Kismayo road without proper cross drainage structures has created temporary or permanent pools. They have been found infested by bilharzia snails.

The groundwater resources are limited and saline in many places. Groundwater tables of sufficient quantity and acceptable quality for domestic purposes are found in the middle and lower reach. Small, shallow freshwater lenses are found in the coastal dunes and in some ephemeral tributaries.

Information on water quality of surface and groundwater resources of the Juba Valley are limited. The Juba Sugar Project monitors water quality of Juba water since 1977 and JESS initiated a one-year study of water quality including surface and groundwater samples.

The data show that EC values (i.e. electrical conductivity; indicating the degree of salinity) are below 0.75 mmhos/cm for most of the year except for the beginning of the Der floods when monthly means of exceeding 1.3 mmhos/cm have been recorded. Phosphate concentrations in solution and suspended sediments are high while nitrate concentrations are relatively low. This means that the Juba is a nutrient rich river which can be used for irrigation. Arsenic concentrations in the lower reach have been found above acceptable levels for drinking water and sulfates in excess of 1,000 mg/l sampled at the end of Jilaal might affect concrete. Bacteriological surveys have not been conducted.

Groundwater quality is poor in many places and EC readings exceeding 10.0 mmhos/cm are found in many wells. The standard of 350 mmhos/cm as an acceptable upper EC limit for potable water is considerably exceeded and people are so accustomed to drinking saline water that they will classify water of up to 1.5 mmhos/cm as sweet water. The community water supply system of Garbaharey, for example, delivers tubewell water of 3.0 mmhos/cm. It is very difficult in the Juba Valley to find surface or groundwater which meets the internationally accepted standards for potable water.

2.3 Land Resources

The Juba Valley is sparsely populated and availability of land is not a major planning constraint. Comparison of population density in Juba Valley with other major river systems does not indicate any population pressure.

Table 2.3/1 Population Densities in Juba Valley and Selected River Systems

	Juba (1)	Lower Nile	Lower Ganges	Yellow River
People/km^2	80	1,400	>1,000	1,000 - 2,000

1) Population density in a 15 km wide stretch along the river.

Land use conflicts for example between agriculture and infrastructural or settlements development which are characteristic for most densely populated river valleys are unknown in the Juba Valley.

There are however apparent problems related to land use, allocation of land and land rights.

Alluvial lands in the floodplain are increasingly taken under small-scale pump irrigation. If this trend continues access corridors and watering places might be endangered and conflicts between sedentary farmers and nomadic livestock holders might evolve. Even at Deshek Radiile which is one of the most important watering places of whole Somalia land is rapidly taken under cultivation. Large-scale agricultural projects have affected traditional migration patterns. It is difficult to assess the impacts of this development mainly because livestock herders are used to flexibly react on such changes.

Environmental implications of land tenure and land rights cannot be overemphasized. Experience in many developing countries shows that the environmental implications of different agricultural systems are closely related to the corresponding land rights. Security of land tenure, for example, encourages farmers to employ sustainable farming practices and to avert soil degradation. Alienable land titles encourage owners to improve the land which will increase its value while short-term tenures force farmers to exploiting the soils.

The size of the farm or estate might also have environmental implications. Large estates are often characterized by monocultures which are prone to crop pests and diseases. High application rates of biocodes are therefore common. Small subsistence farmers plant different crops, usually low yield local varieties which are more resistent to pests and crop diseases and do not require high inputs.

The existing Land Law of 1975 is not conductive to promote ecologically sound farming practices, i.e. farming systems which conserve soil properties and do not cause accumulation of biocides or other agricultural chemicals in water, soils or the food chain. Registered leaseholds may not be bought, sold, subleased rented or mortgaged thus discouraging farmers to improve their lands. Uncleared forest land is regarded as idle land under current interpretation, leading to wasteful clearing of woody vegetation. Individuals can register only one plot. Farmers, used to multiple plot cultivation are vulnerable to natural disasters such as flood or drought. Apparent land speculation and insecurity of land tenure are not conductive to stimulate ecologically sound farming practices.

The large state-owned estates in the lower reach plant mostly monocultural crops (rice, sugar etc.) as do the smaller banana farms.

Due to the general low farming intensity - even in the lower reach vast areas are still uncultivated and only the Juba Sugar Project cultivates its available command area - apparent signs of soil degradation are not detectable and accumulation of pesticides is considered as low. Irrigation has raised the groundwater table (Mogambo); if these areas are not properly drained water logging and salinisation might occur.

2.4 Biosphere

The biosphere of the Juba Valley is dominated by three main ecosystems:

- the freshwater ecosystems including the river, inter-riverine wetlands, desheks or small ponds and pools
- the alluvial flood plain inundated by seasonal floods gradually widening from a few hundred meters at Luuq to several kilometers in the lower reach
- the dry range lands beyond the alluvial flood plain not directly affected by the river system.

The most prominent ecosystem in terms of area as well as biomass is the dry savannah. Its vegetation is dominated by thorny trees (Acacia/Commiphore), shrubs (Grewia/Cordia) and herbaceous growth. Variations on plant associations, canopy closure and biomass production result from soils, precipitation, disturbances by humans or livestock or occasional fires. It is not an undisturbed wilderness area since large nomadic livestock herds have been exploiting it for centuries.

Wildlife, especially large mammals are not abundant. Large mammal herbivores (elephants, giraffes or buffalos) as well as large predators (lions, leopards) were common prior to the Forties but have been largely exterminated. Smaller herbivores including lesser kudu, duiker and dik-dik are still common as are baboons or warthogs.

Where soils and rainfalls are favourable large parcels of bushlands have been cleared for rainfed agriculture. Levels of farm technology are low as are crop yields. The individual plots are large; protective measures such as strip plantations of trees to reduce wind speed and to improve the micro-climate exceptional.

The bushland serves as habitat for wildlife, provides forage for the large nomadic herds and raw materials for various uses, for example building materials, medical herbs or fuel wood. Apparent impacts affecting its ecology include the above-mentioned conversion into agricultural lands, overgrazing and overbrowsing caused by overstocking and overextraction of firewood.

Denudation caused by overextraction of firewood is visible around major settlements in particular around the refugee camps. Some hundred square kilometers have been severely affected, partly beyond the natural recovery. This area is, however, small compared to the total bushland area. Adverse impacts on wildlife or livestock are thus limited to local disturbances. The population, however, is severely affected since prices for firewood are going up and time needed for firewood gathering substantially increases.

The present stocking density is believed near the carrying capacity of the rangelands. Apparent signs of overgrazing and overbrowsing have been reported by local officials of the Afmadow area where watering wells and reservoirs so-called "wars" attract large herds during the dry seasons. It is, however, not possible to assess whether this observation indicates only temporary overexploitation or beginning deterioration. Nomadic pastoralism is an extremely flexible, ecologically sound strategy to avoid overgrazing as far as possible. In addition, the bushland vegetation of Somalia is adapted to harsh environmental conditions and its regenerative capacity still is relatively high.

The ecological implications of rainfed agriculture are virtually unknown. Conversion of bushlands into large field plots irreversibly destroys the bushland habitat. Since large areas are earmarked for future development substantial wildlife populations are affected. Crop residues are used as supplemental fodder for livestock. The question whether this agricultural system can be maintained on a sustainable basis needs to be further investigated. It is deplorable that despite its social and economic importance rainfed agriculture has not been scrutinized with respect to its ecological implications.

The natural vegetation of the flood plain is dominated by Phyllanthus and Acacia associations. Its biological productivity is substantially higher than that of the bushlands. At one time rich riverine gallery forests covered the Juba Valley flood plain. Most of them have been cleared especially during the last two decades when gallery forests declined from 9,500 ha in 1960 to 900 ha in 1987. These forests represent the northernmost extension of East African lowland forest and contain wildlife species which are not found elsewhere. Two viable sites for protection have been identified at Barakow Madow (140 ha) and Shoonto (265 ha) and declared as forest reserves by the National Range Agency (NRA). They still need to be gazetted, delineated and effectively protected by an according reserve management plan. In order to stop ongoing clearing fast action is needed.

Vast parts of the river flood plain are agricultural lands. The upper reach from Gedo/Luuq to Saakow is dominated by rainfed agriculture and small-scale pump irrigation the latter rapidly expanding. The desheks of the middle reach (Saakow to Fanoole Barrage) are cultivated in an unique form of recession agriculture. Deshek agriculture is characterized by low mechanization, low inputs and use of local varieties. It is, however, perfectly suited to supplement the livestock sector with crop residues as fodder. The intensive agricultural systems in the lower reach do not produce palatable crop residues.

Apart from the rapidly dwindling gallery forests the floodplain ecosystems are still stable and coexistence between agriculture, livestock and natural flora and fauna seems balanced.

The waterbodies may be subdivided in the following way:

- the river

- ephemeral tributaries (after strong rainfalls)

- permanent and semipermanent swamps and wetlands including:
  . desheks
  . lower Shebelli swamps
  . large depressions (Deshek Waamo)

- permanent and semipermanent ponds/pools mostly along the Fanoole canal and the Fanoole - Jilib - Kismayo road (roadside ponds)

- irrigation canals and drainage systems

- small, temporary waterbodies caused by local runoff during the wet seasons.

Their ecological significance is high, in particular as habitat for disease vectors. The health sector proves waterborne diseases among the primary causes for morbidity and mortality in the Juba Valley. Those diseases related to water include bilharzia (schistosomiasis), malaria and diarrheal diseases (dysentery, cholera, typhoid, hepatitis).

Only the urinary form of bilharzia (Schistosoma haematobium) has been found in the Juba Valley. The parasite is transmitted in a complex cycle by freshwater snails (Bolinus abyssinicus). Infested waterbodies identified include roadside pols, irrigation drains of banana plantations and some desheks while the river itself and irrigation canals are from bilharzia snails.

The principle malaria vector is the Anopheles mosquito (Anopheles arabiensis). Transmission of the disease occurs throughout the year with peaks in July and December following the rains by about one month. Potential habitats include temporary and permanent stagnant water bodies with low turbidity. Of great concern is a recent introduction of a choloroquine resistant form of malaria. The disease is particularly virulent causing death if not properly treated.

Diarrheal diseases are common throughout the valley but no bacteriological or viral water quality surveys have been conducted so far. Many water bodies used for bathing, washing etc. are contaminated particularly at the end of the dry season when their size is reduced and the rains wash in surrounding fecal contamination. Only deep well drinking water is free of bacteriological contamination. Table 2.4/1 summarizes the poor status of water supply in the valley. It must be noted here that a substantial reduction of water borne diseases requires strict avoidance of any contact with contaminated water. Provision of safe drinking water would show only marginal results of the population still uses contaminated water for bathing, washing etc. Experience in other developing countries has shown that in bilharzia infested areas only piped in water will lead to a substantial reduction of the disease.

Table 2.4/1 Potable Water Supply in Juba Valley

Location	Source	Quantity	Quality	Improvements needed
Luuq	Juba	sufficient	poor	treatment, distribution
Bardheere	Juba	sufficient	poor	treatment, distribution
Saakow	deep well	sufficient	acceptable	distribution
Bu'aale	deep well	sufficient	acceptable	distribution
Jilib	deep well	sufficient	acceptable	distribution
Jamaame	deep well	sufficient	acceptable	distribution
Kismayo	Juba	partly insufficient	very poor	treatment
Afmadow	shallow well	insufficient	undetermined	new source, treatment distribution
Dinsor	war, water trucks	insufficient	very poor	new source, treatment distribution
Villages	Juba desheks wells	mostly sufficient	poor to very poor	new sources, treatment of river water

Note: No regular water quality monitoring in Juba Valley.

Some water bodies listed above act also as an important habitat for fish and wildlife. Hippo and crocodile populations flourish in the river and some wetlands. The local residents consider hippos as a major crop pest and crocodile incidents concerning humans and livestock are frequently reported; the need of a crocodile control programme seems obvious.

The river is a rich habitat for freshwater fish. The potential sustainable annual catch of some 1,600 metric tons is grossly underused. Most fishing is intended for household consumption, the surplus is sold at local markets. A substantial increase of catches would require an crocodile control programme. At present fishermen ask for aid from soldiers to kill crocodiles at preferred fishing sites.

Of great importance to wildlife and livestock are the wetlands, in particular the inter-riverine swamps between the Shebelli and the Lower Juba Rivers. It seems that wildlife is still in balance with human use (livestock, agriculture) but further development (expansion of agricultural lands; change of nomadic migration patterns) might require protective measures.

2.5 Major Issues in Need of Immediate Actions

This brief overview on the present ecological situation in the Juba Valley might be summarized as follows. By and large the overall ecological balance in the Juba Valley might be considered as stable but increasingly subject to stress. Air pollution is nonexistent and land for further development available. If not controlled the agricultural development might impede traditional livestock movements (access corridors). The river flow is sufficient for nine months of the year and salinity levels are mostly within tolerable limits. During Jilaal season a reduced flow causes saltwater intrusion in the lower reach and irrigation pumping virtually stops. Groundwater resources are limited and frequently too saline for humans or livestock. Ecological degradation is apparent around major settlements along the river caused by grazing, browsing and extraction of firewood. Many surface water bodies are infested by disease vectors and waterborne diseases are prevalent in the valley.

Most of the environmental problems in need of immediate solutions (without-dam situation) are either related to water, its availability, its quality and its role as habitat or to the overextraction of biomass by grazing, browsing and extraction of firewood.

A major issue is disease vector control considering the portion of the population affected and the socioeconomic impacts of the diseases. The transmitting disease vectors are part of the natural environment; their habitats and their migration patterns are, however, influenced by human activities. Construction of the Fanoole canal and of roads without proper cross drainage structures have created small temporary or permanent pools. These pools have been found heavily infested by bilharzia snails and contribute to the transmission of the disease. Timely incorporation of health impacts into the project design, for example by constructing sufficient cross drainage structures, filling of depressions, controlling of disease vectors by physical, chemical or biological means would have prevented this disaster. Existing or new irrigation schemes must not be a major habitat for bilharzia snails or malaria mosquitos. Proper design of canals, irrigation structures, fields and drains as well as their maintenance, especially removal of sediments and aquatic vegetation could minimize disease vector infestation. Selection of appropriate crop rotation patterns would also be an efficient instrument of mosquito and snail control. Outside of irrigation fields vector control should include filling of depressions, improving drainage and planting of trees which evapotranspirate large amounts of water.

New settlements should be located some kilometers away from infested water bodies and should have their own water supply system. Piped-in water which is safe for human consumption substantially reduces disease transmittance.

These few examples show that an integrated approach is needed to effectively control disease vectors. All projects liable to cause adverse health impacts should have an according health component. An integrated disease vector control programme is needed for Juba Valley in order to eradicate or minimize habitat infestation at least in the vicinity of settlements. Improvement of sanitary conditions (basic sanitation) is additionally needed as are training and information campaigns.

This leads to a second issue which is related to water and its use. Small-scale irrigation pumping has to be regulated in order to reduce saltwater intrusion as far as possible. It will, however, not be possible to totally avert saltwater intrusion during extreme low flows. It is therefore additionally necessary to rehabilitate the Kismayo water plant and to develop additional water sources to supplement the city during periods of saltwater intrusion. Other communal water supply system in need of immediate upgrading include Luuq, Bardheere, Dinsor and Afmadow. Monitoring of potable water quality based on internationally accepted methods should be institutionalized and start as soon as possible.

A third major issue is conservation i.e. wise use of the valley's biological resources. Protection of the valley's remaining gallery forests calls for immediate actions. This should be part of a conservation strategy needed to preserve important habitats, in particular inter-riverine wetlands and desheks. Such a conservation strategy which should lead to a conservation programme would not impede traditional livestock movement patterns but prevent agricultural expansion in ecologically sensitive wetlands.

Agricultural research envisioned for some experimental farms should not be limited to investigate the viability of certain cropping systems. In addition harmonizing cropping systems with the fodder requirements of the livestock sector should be investigated. Another important complex includes research on sustainable farming systems. The applicability of techniques such as strip plantations of trees, soil improvement by mulching, application of organic fertilizers, integrated plant protection instead of mere use of biocides should be investigated for irrigated as well as dryland farming systems.

It will be difficult to control overextraction of firewood particularly around refugee camps. Substitution of biomass fuel for example by solar energy might prove as too expensive for the individual household. Energy efficient cooking stoves which can be produces locally should be developed and promoted. Range management and livestock development should consider overgrazing and overbrowsing as a possible consequence of programmes and projects attracting livestock concentrations. Each project liable to increase the attractiveness of an area for livestock, for example by provision of new water sources, improvement of services etc. must investigate whether the carrying capacity of the surrounding rangelands might be exceeded. As a first step quantitative research on carrying capacities of different rangeland types is needed.

3. Environmental Impacts of Bardheere Dam

Many African dam projects have caused lasting negative environmental impacts. The planning stage of the Bardheere Dam has therefore been accompanied by according environmental surveys - notably the JESS project - in order to identify such impacts and mitigating measures needed to remedy them.

Environmental impacts of a dam project are usually subdivided into:

- environmental impacts caused by dam construction
- environmental impacts caused by dam operation.

Their occurrence is different in time, nature and location. Therefore they have to be dealt with separately.

3.1 Environmental Impacts During Construction

The construction period is characterized by movements of people, goods and earth. Residents of the future reservoir area have to be resettled to new sites, construction workers move to the construction camp. Goods and materials have to be hauled to the construction site, the reservoir has to be cleared from vegetation and a major component of construction includes earth works. Major impacts include health and sanitary problems caused at the camp site where several thousand workers and their families have to be accommodated within few months. The social effects for Bardheere will be substantial. Resettlement programmes, if not designed according to environmental requirements might entail health risks and earth works might lead to erosion and siltation and to creation of habitats for disease vectors.

Resettlements is a major issue with social and environmental implications. Some 13,000 sedentary farmers and 100,000 refugees live in the reservoir area. Suitable resettlement sites have been identified only in the middle and lower reach. A resettlement study conducted by Halcrow Fox Associates Ltd. has addressed some environmental implications of resettlement, for example availability of firewood. This study is, however, not complete; prevalence of disease vectors at proposed settlement sites has not been studies. Some of the sites are in fact known as bilharzia infested. Disease vector control by means discussed above (see Section 2.5) must be an integral part of the resettlement loans. Land tenure is another issue of social and environmental importance. The proposed allocation of land to individual households and security of land tenure are important incentives to farmers to employ ecologically sound farming practices discussed above (see Sections 2.4 and 2.5).

The construction camp will host a population comparable to other major settlements in the valley. Uncontrolled development would result in unsanitary living conditions eventually causing the outbreak of contagious diseases. Waterborne diseases would be prevalent. A masterplan is needed to control and guide the development of the camp which will later eventually develop into a major permanent settlement.

Important components of the masterplan would include safe potable water supply, basic sanitation, eradication and control of disease vector habitats and primary health care. Bardheere town would also substantially grow during the construction period. To curb adverse impacts of a "boom town" development an according masterplan for Bardheere is needed. It is vital that basic works on those masterplans starts as soon as the Bardheere Dam Project has been finally endorsed.

Hauling of construction materials to the dam site either from Mogadishu via Baydhabo - Bardheere or from Kismayo via Jilib - Bardheere will put enormous stress on the roads. Budgetary allotments for road maintenance and repair works has to be increased accordingly.

Erosion and siltation caused by earth works (construction site preparation, access roads etc.) will not be severe since the dam is either rock-fill or "roll-crete" and rainfalls are low. It is, however, necessary that access roads are properly drained to avoid creation of stagnant pools which might act as disease vector habitats.

3.2 Environmental Impacts During Operation

Environmental impacts during operation are usually considered for the following geographical units:

- the catchment area
- the reservoir
- the downstream area.

3.2.1 Catchment Area

Water quantity as well as quality depends on the vegetation and/or land use in the catchment area. Any natural or man-made development affecting the vegetation might result in changes of water availability or quality. It is important to recall that erosion and siltation rates of a moderately hilly catchment area might vary over two orders of magnitude, depending on vegetation cover. According to JESS the active catchment of Juba, e.g. the part of the catchment that contributes to the river flow, is relatively small; perhaps as much as 90 percent of the mean annual runoff in the Juba River at Luuq originates from less than 10 percent of the total catchment area, lying in the Bale Mountains of Ethiopia (JESS Report No. 21).

Knowledge of land use and monitoring of land use trends in the catchment area are needed for two reasons: Firstly, denudation might substantially increase the sediment load of the inflowing water thus shortening the life span of the reservoir. Secondly, agricultural development in the catchment area, in particular irrigation might drastically increase water losses thus lowering the inflow into the reservoir as well as eventually increasing the salt load. Bilateral and multilateral cooperation between the countries concerned should assure that the development of the active catchment area of the Juba will not jeopardize the dam project.

3.2.2 Reservoir

Most of the flooded reservoir is marginal rangelands. Approximately 3,000 ha of the area is flood plain cropland which is a relatively small loss when compared to the development potential in the downstream area. In addition deposition of sediments and floating vegetation in the drawdown zone will improve the soil structure thus creating new lands for flood recession agriculture.

The water quality of the reservoir is not adversely affected by upstream industrial development or use of biocides which is negligible at present levels. Salinity will be under 0.5 mmhos/cm for most of the time. Since the inundated biomass is low when compared to the reservoir's volume oxygen depletion caused by decomposition is not expected to be excessive.

The Juba river carries, however, high concentrations of phosphates in solution and sediments. Together with the decomposition of organic materials eutrophication, i.e. increased primary production might be expected during the first few years. Water weeds such as water hyacinth (Eichhornia sp.) or water lettuce (Pistia sp.) might infest the reservoir although existing wind and wave patterns are not conductive for their proliferation. Additional intakes of phosphate might be caused by droppings of livestock grazing in the drawdown zone. River and reservoir water quality monitoring is therefore necessary as well as limnological monitoring, particularly in the first years.

The reservoir, in particular protected coves and inlets will act as suitable habitat for mosquitos. A population simulation of bilharzia snails in the reservoir indicates that the reservoir would be generally unfavourable for all species of bilharzia snails. On the other hand, most African reservoirs are infested by bilharzia snails. Health impacts will largely depend on the development of new settlements and migration patterns of nomadic livestock holders. A development programme that includes health care, water supply and sanitation and disease vector control would minimize adverse health impacts caused by the reservoir. Reservoir operation, in particular periodic drawdown contributes to strand large of disease vectors thus minimizing disease vector infestation of the reservoir.

Another impact is a possible backwater effect at Luuq. The river enters the reservoir at Luuq. The city lies on an oxbow of several kilometer length. At the entrance of Luuq this oxbow is less than 50 meter wide. The sediment intake into the reservoir during high water levels, therefore will (partly) settle in the Luuq reach eventually causing backwater effects. The unknown river morphology in this reach and the lack of reliable sediment data do not allow to predict possible changes in the river morphology and their impacts on Luuq. A qualitative assessment based on morphological investigations should be conducted prior to the dam operation in order to identify terms of references how to adequately address this issue.

The reservoir will cause rising groundwater levels. This might dilute saline groundwater to render it potable, a process, however, not likely to show results in the short term.

Eutrophication during the first years will rapidly increase fish populations in the reservoir. After some years nutrient intake and a growing population of predators will create a new equilibrium. Fish yields will be considerably lower compared to the first years but sufficient to support a flourishing fishing industry.

3.2.3 Downstream Impacts

Most downstream impacts are related to hydrological changes of the river regime. The dam will change the released water quality as well as river flow patterns.

Resulting impacts might be subdivided into direct and indirect impacts, the latter caused by the development brought about by the dam, in particular irrigation development.

An important direct downstream impact is river scour.

The reservoir acts as sediment trap, retaining as much as 90 percent of the inflowing sediments. As a result the released water is relative free of sediment. Such water is highly erosive, taking up sediments from the river bed until suspended materials come into equilibrium with the flow velocity. This process is called river scour. Existing riverine structures are extremely vulnerable to this process, in particular bridge foundations, pilings, irrigation intakes and the like.

A river may respond to changes in water and sediment volumes in several ways:

- changes in cross-sectional form of the river (e.g. depth, width, depth/width ratio)

- "armoring" of the bed (i.e. selective transport of bed materials, leaving a coarser fraction in place)

- changes in the planform of the river (e.g. meander wavelength, sinuosity of the channel)

- changes in the gradient of the channel (JESS Report No 21).

An investigation of the morphology of the Juba River has yet to be conducted. The data at present available do not allow reliable prediction where river scour might substantially change the river morphology. This process is however slow, gradually eroding the river bed over years. Monitoring of the river morphology at crucial points (structures, irrigation intakes, potential sites of barrages etc), therefore, is urgently needed once the dam becomes operational.

Flood control is apart from electricity generation and irrigation a major purpose of the dam. Discharge will remain below the river bank capacity (800 m^3/s in the upper reach, 300-400 m^3/s in the lower reach) except for extreme flood events. Flood damage will be greatly reduced.

The altered river regime - nearly constant flow in dry years, a pronounced flood peak during the Der season in wet years - will affect downstream area. The constant flow will prevent saltwater intrusion in the lower reach. Potable water supply of Kismayo will particularly benefit from it. The impacts on the remaining riverine forests are difficult to forecast, however, according to JESS unlikely to be adverse. Yields in riverine fisheries are likely to decline to an extent yet to be estimated. Deshek fisheries will disappear in those desheks no longer subject to seasonal flooding.

Downstream impacts on groundwater will depend on the season and on irrigation development. Dry season groundwater tables would be principally higher while wet season groundwater tables lower with accordingly reduced flood levels. Substantial expansion of irrigated areas would rise water tables in the valley.

The ecological and social impacts on desheks will depend on the dam operation. Low lying desheks starts flooding when the river flow exceeds 400 m^3/s while most desheks are flooded when the flow exceeds 700 m^3/s. Controlled deshek flooding is therefore possible at least in wet and normal years.

Trapping of sediments in the reservoir will reduce the nutrient load in the downstream reach. This will reduce nutrient deposition in the flood plain requiring substitution by fertilizers. The extend of additional fertilizers needed to offset this effect has yet to be estimated.

The most important downstream impacts are indirectly caused by the dam. Irrigation is apart from electricity generation a major purpose of the dam. Experience with many irrigation projects in the downstream area of artificial reservoirs has often been discouraging. Actual crop yields were often far below expectations, health conditions drastically deteriorated due to disease vector infestation of irrigation facilities and water logging and salinisation affected soils. According to FAO estimates some 10 million ha of irrigated land are annually taken out of agricultural production due to salinisation.

It is fair to guess that without a guided and controlled development which counteracts all possible negative impacts of irrigation the Juba Valley would just be another example of a development failure. Areas earmarked for further development are already infested by disease vectors and without strict water and irrigation management salinity problems will occur. Salinity level simulations for the river show during a dry year and under certain return flow assumptions EC levels exceeding 0.75 mmhos/cm from Fanoole downstream to the ocean for six months of the year.

It will be extremely difficult to predict future salinity levels which depend on various factors of influence (irrigation efficiency, soils, drainage, return flows, cropping patterns etc.). It is, however, fortunate that the expansion rate of irrigated areas in the valley is generally low leaving enough time to counteract unacceptable increases of salinity levels. This requires a continuous water quality monitoring programme and a computation of the water quality of return flows for newly developed irrigation schemes.

4. Institutional Responsibilities

The environmental issues highlighted in the previous sections are neither complete nor dealt with in such detail that immediate actions can follow. The available JESS reports have discussed in great detail various issues and made some hundred specific recommendations each requiring a specific programme, project or measure. But the recommendations made do not include exact implementation plans, budgetary requirements, needed manpower or institutional responsibilities. In short, the question of the next steps to be undertaken is still open. This requires a discussion of who will be responsible to decide which of the numerous recommendations need to be implemented, who will be responsible for their implementation and who will shoulder the expenses incurred.

Somalia has no specific environmental legislation nor declared environmental policy. Environmentally related responsibilities lie with sectoral ministries and authorities, in particular with the Ministry of Health (environmental health, sanitation, disease vector control), the Ministry of Agriculture (plant protection; land tenure) and the National Range Agency under the Ministry of Livestock, Forestry and Range (forestry, range management, conservation).

Initiation, supervision, coordination and monitoring of environmental programmes, projects and measures should lie with a single environmental authority. Many of the programmes and projects are complex and require cooperation of various line agencies. Experience in many other developing countries has shown that such environmental authority is an efficient institutional solution.

It is however obvious that the need for environmental management is not limited to Juba Valley alone. Two options seem plausible to deal with environmental management in Somalia in general and in Juba Valley in particular:

- creation of a national environmental authority with responsibilities for Somalia as a whole including Juba Valley

- creation of an environmental department within MJVD responsible for environmental management in Juba Valley. This department might become the nucleus of a national environmental authority to be established later.

The need for a national environmental authority in Somalia is obvious. Its establishment, however, would be time consuming due to the need for formulation and promulgation of pertinent policies, laws and regulations. Establishment of an environmental department within the MJVD on the other hand could easily be incorporated into the present restructuring of the ministry. Thus the second option seems more reasonable and pragmatic to meet the need for fast action.

Establishment of such department will require more in depth analysis with respect to existing legislation, administrative responsibilities as well as analysis of performance of existing programmes and projects. This should be a major activity during the third phase of the Masterplan.

The principle objectives of such department should be the following:

- natural resources of Juba Valley, in particular water, land and biological resources will be used and managed on a sustainable basis
- adverse environmental impacts caused by development projects in Juba Valley in particular by the Bardheere Dam Project will be identified, assessed with respect to their planning relevance and, if required, mitigated
- existing resource degradation and pollution will be counteracted by appropriate means and measures.

The department should be mandated to execute the following tasks:

- to formulate more detailed, sector specific guidelines assuring the environmental soundness of development in Juba Valley
- to set, monitor and enforce environmental standards
- to identify, initiate, finance, implement and monitor programmes and projects for ecologically sound resources management and enhancement of environmental quality
- to prepare and enforce guidelines and procedures to assure the environmental soundness of development programmes and projects (environmental impact assessment)
- to coordinate the environmental activities of other institutions
- to initiate, coordinate, conduct and supervise needed environmental monitoring measures
- to initiate, coordinate, conduct and supervise environmental research and environmental investigations
- to initiate, coordinate and conduct training for personnel of other institutions.

Implementation of environmental programmes, projects and measures should be under the responsibility of the concerned line agency, for example MOH for health related programmes or NRA for conservation programmes. Expenses needed to mitigate adverse impacts of a certain project should be shouldered by that project. The environmental department should have its own budget to implement own projects for example monitoring or research.

5. Guidelines for Environmental Management in Juba Valley

The following guidelines are intended to provide a framework for the beginning discussions about institutionalizing environmental management in Somalia. They might be helpful to identify effective and pragmatic strategies needed to solve environmental problems. They are general in nature and cannot directly be used to solve a specific problem but might guide the search for an appropriate approach to tackle problems.

5.1 Management of Natural Resources

Natural resources should be conserved, i.e. wisely used and managed on a sustainable basis. Any management strategy or programme should be based on the following information:

- spatial distribution of available resources in terms of quantities as well as qualities (resource inventory)
- production or recharge rates of natural resources depending on the various factors of influence
- inventory of existing use of natural resources
- estimation of maximal and optimal allowable extraction rates
- estimation of demand for natural resources depending on time and location.

Based on this information it is possible to manage extraction and use of natural resources at least in principle. Considering local conditions and the quality of information usually available, resources management will face two constraints:

- information is insufficient for reliable and quantitative estimations of optimal extraction rates
- institutions in charge of resource management lack a strong legal mandate and the needed manpower to enforce strict management principles.

The consequences are obvious. The legal mandate of institutions in charge of resource management must be strengthened, their competence improved and more accurate resource inventories are needed.

Resource management is needed for water, land and biomass. Some basic objectives and principles have been outlined in the previous sections. The following additional guidelines might prove helpful to identify, design and effectively implement needed programmes and projects.

(i) Water Management should be based on the following principles:

- water supply for people and livestock should have highest priority among all uses. This condition can be easily met since the quantities needed are small compared to the surface water resources available

- all de facto water rights (this refers in particular to the irrigation projects in lower Juba) should be legalized

- existing and future water use (except for potable water supply) should be subject to allocation management based on water licensing

- water licensing should lead to improvement of irrigation efficiencies preferably through water-use charges or similar incentives

- water use should not lead to substantial decrease in water quality.

(ii) The dry land vegetation is adapted to the harsh environmental conditions of the country and its regenerative capacity is high. Experience has shown that closing of bush land for grazing and browsing for two successive wet seasons (Gu and Der) will result in a substantial recovery of the vegetation (British Forestry Project). Range management should be based on this fact. Again, acceptance of the local population is vital for the success.

(iii) In general, nomadic livestock keeping might be regarded as ecologically sound. The basic strategy is risk-spreading. Overgrazed areas are avoided, if possible. Range management should be based on a similar strategy: underutilized range lands should become more attractive by provision of water and services, overutilized areas should become less attractive.

(iv) Comprehensive solutions are needed in order to preserve the ecological balance. This must include a more rational use and, if needed, substitution of resources subject to overutilization. This calls for more fuel-efficient cooking stoves which might be locally made and provide additional income for the potential producers. Experience in Kenya has shown that a simple, locally made stove might save as much as two-thirds of fuel wood. Solar cooking stoves might be another solution.

(v) Irrigated fuel wood plantations will not meet the demand for fuel wood. However, strip plantations of trees along irrigation facilities and fields will provide ample benefits for the people, in particular increased crop production through reduced wind speed and evapotranspiration supplemental wood as well as fruits. Tree planting should be an integral part of all agricultural development schemes.

(vi) The need for land use allocation has been explained above. Major watering places for nomadic livestock should meet the following conditions:

- free access to the water source
- control of disease vectors in the water
- provision of safe potable water supply for the nomads
- provision of grazing lands in the vicinity
- provision of health facilities
- provision of veterinary facilities.

(vii) Conservation strategies have concentrated on rangeland and gallery forest conservation. In addition preservation of some ecologically significant desheks should be included into a conservation strategy.

5.2 Mitigation of Adverse Environmental Impacts

Many countries have established procedures to deal with adverse impacts resulting from development projects. The approach usually applied is called "Environmental Impact Assessment" (EIA). Projects, liable to cause adverse environmental impacts, are subject to EIA. The procedure normally consists of the following steps:

- initial environmental examination (IEE) which is a rapid assessment of potential environmental impacts and serves as decision basis whether or not a full-scale EIA is needed

- scoping - determining the Terms of Reference for the environmental impact study, the centerpiece of the procedure

- conducting of the EIA and publishing the results in a report (the environmental impact study). The contents of an EIA usually include:

  . a project description
  . an analysis of sources of environmental impacts
  . a description of the environment in the project area
  . an assessment and evaluation of environmental impacts
  . comparison of environment without vs. with project
  . proposed mitigation measures needed to assure the environmental soundness of the project

- final acceptance (or rejection) of the EIA report and hence the project

- implementation of the mitigation measures, usually by the project proponent.

Large dam projects are usually subject to EIA. The JESS project has identified relevant impacts caused by the Bardheere Dam Project and discussed possible mitigation measures. A full scale EIA requires in addition more detailed information on the needed mitigation measures in terms of:

- institutional responsibilities for their implementation
- needed budget, resources, time frame
- compliance monitoring.

These issues have to be resolved before dam construction starts. A clear cut decision on specific responsibilities of the Bardheere Dam Project and MJVD with respect to environmental management is urgently needed. The following competence-sharing arrangement seems plausible:

- the Bardheere Dam Project would have the administrative responsibility to mitigate adverse environmental impacts occurring during the construction phase, particularly resettlement, reservoir clearing, erosion control etc.

- MJVD would be responsible for environmental management in the downstream area and during the operational phase of the dam.

Environmental management has to assure the environmental soundness of all major development projects in the Juba Valley. Establishment of specific EIA procedures, however, is not recommended. International experience with EIA has proven this approach time consuming and often rather academic. It is therefore recommended that the environmental soundness of projects in the Juba Valley be checked by employing the following guidelines which are tentative in nature and in need of improvement.

Irrigated agriculture development projects are liable to cause the following adverse environmental impacts:

- increased infestation of waterborne disease vectors in irrigation facilities
- increased soil salinity if not properly leached and drained
- reduction of crop residuals usable as fodder
- reduction of grazing lands
- water pollution due to runoff of agro-chemicals.

Such projects might be considered environmentally sound if the pertinent project documents address aforementioned issues and provide appropriate solutions, depending on the nature of the project and the environmental conditions of the planning area. To decide on the appropriateness of information provided the following guidelines might be helpful.

(i) Disease vector infestation must be expected in most pump or gravity irrigation schemes. The project papers must indicate the responsibility for disease vector control. Mechanical, biological and chemical control measures must be discussed and a plan to deal with related problems should be an integral part of the project.

(ii) To avoid soil salinisation in irrigation projects the project documents must address this issue. Based on salinity levels of irrigation waters and soils, leaching and drainage requirements must be computed and the suggested irrigation patterns must comply with those requirements. For large projects changes in the salinity levels of Juba waters (increasing salinity after the completion of large irrigation schemes in the Saakow/Bu'aale area) should be considered, too. Computation of the salt balance of the Juba River for various irrigation development scenarios is a necessary prerequisite.

(iii) Substantial promotion of crops whose residues cannot be used as fodder for livestock should be assessed with respect to the impacts on the livestock sector. If necessary, new fodder sources should be developed.

(iv) To minimize water pollution the project documents should discuss appropriate means, for example, use of organic fertilizers, integrated pest control, etc. and incorporate feasible solutions into project design and operation.

(v) Land tenure regulations for the newly developed areas should consider traditional land use and land rights. This should be an integral part of the project and subsequently covered by the project documents.

Other projects liable to cause adverse environmental impacts include construction of large structures, in particular roads and main irrigation canals. The Fanoole canal, for example, has been constructed without any cross drainage structures over a total length of 56 km. This has increased flooding, waterlogging, created pools of stagnant waters and increased suitable habitats for disease vectors. Incorporation of environmental considerations into project design and implementation of large constructions, therefore, is an important requirement. This refers particularly to the new Bardheere - Jilib road whose construction is due to start soon.

The project design of such projects must assure that drainage is not impeded, flooding and waterlogging are minimized and no permanent or temporary water bodies will be created. A road project might be considered environmentally sound, if the pertinent project documents clearly indicate drainage patterns, particularly in the wet seasons, needed cross drainage structures are designed according to accepted engineering standards and creation of stagnant water bodies is avoided. The operational budget of the project must include allocations for earth works eventually needed after project implementation, for example, if filling of depressions is necessary.

5.3 Enhancement of Environmental Quality

The third major thrust of environmental management includes projects and activities needed to counteract environmental degradation and to enhance environmental quality. The pressing issue with respect to resource degradation in the Juba Valley is overextraction of range land biomass (extraction of firewood, overgrazing). One-dimensional approaches, for example, reforestation or fuel wood plantations, will not solve the problem. Overgrazing could be checked by increasing the attractiveness of range lands yet undergrazed. In other words, existing ecological degradation of range lands should be counteracted by comprehensive range management (see above).

Many agricultural projects may contribute to enhance environmental quality, for example through strip plantations of trees, soil improvement by mulching, integrated plant protection instead of relying on pesticides only, application of organic fertilizers etc.. Such practices will not only improve environmental quality but may substantially increase crop yields. Existing projects were not designed or operate to meet this objective. It is strongly recommended that future agricultural development projects should include improvement of environmental quality as additional major development objective. Every project should therefore include:

- strip plantations along irrigation canals and fields in order to improve the microclimate and to provide fuel wood and fodder
- planting of fruit and shade trees
- promotion of organic fertilizers
- promotion of soil improvement techniques (e.g. mulching)
- integrated plant protection programme
- diversified crop production whose residues may be used as fodder for livestock.

It must be noted here that these guidelines are tentative in nature. Improvements based on internationally available guidelines and handbooks are vital in order to provide more detailed and specific tools for the various tasks outlined above. Prior to this the Government of Somalia has to commit itself to environmental soundness of development as a major development objective by formulating and adopting an environmental policy for the Juba Valley and establishing a responsible administrative unit for its execution.

6. Conclusions

(i) By and large, the overall ecological balance in the Juba Valley might be considered as stable but increasingly subject to stress. Air pollution is nonexistent, land for further development is available, water availability and quality, however, are limited, ecological degradation apparent but confined to smaller areas.

(ii) Most of the pressing environmental problems are related to water, its availability, its quality and its role as habitat in particular for disease vectors as well as to overextraction of biomass of the range lands mainly by grazing, browsing and extraction of firewood.

(iii) Environmental problems in need of immediate solution include the following:

- integrated disease vector control and improvement of potable water supply. The majority of the population is severely affected by various waterborne diseases caused by poor potable water supply, contact with waters infested by disease vectors and infection by insects breeding in or living off water bodies

- water quantity and quality management which is urgently needed in order to wisely use this limited resource on a sustainable basis

- integrated management of biomass use considering the dry rangelands and the river valley ecosystems as one interrelated system formed and used by nomads as well as sedentary farmers

- conservation of significant but sensitive ecosystems which are in danger of extinction if not preserved by strict measures.

(iv) Construction and operation of the Bardheere Dam will entail benefits as well as adverse environmental impacts. The major issues in need of environmental management include the following:

- construction of the dam should be based on sound engineering standards minimizing adverse environmental impacts

- resettlement programmes should assure acceptable sanitary conditions at the new settlement sites and limit overextraction of biological resources

- hydrological changes in the catchment area should be monitored by a water quantity and water quality monitoring programme

- probable eutrophication levels of the reservoir should be computed and additional intake of nutrients should be limited my appropriate means

- infestation of the reservoir by disease vectors must be controlled

- river scour must be monitored at important sites

- the impacts of backflows on Luuq must be further investigated in order to provide appropriate and timely solutions

- development of irrigation schemes in the downstream area will cause infestation of waterborne disease vectors. It is vital to include those schemes into an integrated disease vector control programme.

(v) In many developing countries development projects liable to cause adverse environmental impacts are subject to a procedure that will identify those impacts and assures the implementation of needed mitigation measures. Such procedures do not yet exist in Somalia.

(vi) Somalia has no specific environmental legislation nor declared environmental policy. The country lacks an environmental authority which coordinates and integrates needed activities of various institutions into a coherent environmental management strategy for the Juba Valley.

(vii) The various tasks listed above clearly indicate the need for establishing an environmental authority responsible for coordinating and integrating an environmental management plan that will assure the environmental soundness of development in the Juba Valley.

7. Recommendations

(i) An environmental policy should be formulated for the Juba Valley which should pursue the following principle objectives:

- natural resources of the Juba Valley, in particular water, land and biological resources will be used and managed on a sustainable basis
- adverse environmental impacts caused by development projects in the Juba Valley in particular, by the Bardheere Dam Project will be identified, assessed with respect to their planning relevance and, if required, mitigated
- existing resource degradation and pollution will be counteracted by appropriate means and measures.

(ii) It is advisable that an environmental unit or authority be established, preferably as department of MJVD.

(iii) This environmental department would be responsible to execute the following tasks:

- to formulate detailed, sector-specific guidelines assuring the environmental soundness of development in the Juba Valley
- to set, monitor and enforce environmental standards
- to identify, initiate, finance, implement and monitor programmes and projects for ecologically sound resources management and enhancement of environmental quality
- to prepare and enforce guidelines and procedures to assure the environmental soundness of development programmes and projects (environmental impact assessment)
- to coordinate the environmental activities of other institutions
- to initiate, coordinate, conduct and supervise needed environmental monitoring programmes
- to initiate, coordinate, conduct and supervise environmental research and environmental investigations
- to initiate, coordinate and conduct training for personnel of other institutions.

(iv) Reference materials (handbooks, manuals etc.) needed for environmental management should be procured by the MJVD preferably by requesting assistance from UNEP (United Nations Environment Programme) Headquarters in Nairobi, Kenya.

(v) Environmental management in the Juba Valley should be based on guidelines outlined in Chapter 5 of this report.

(vi) Foreign assistance for the establishment of an environmental management department within the MJVD is needed because Somalia lacks manpower, expertise and resources for this task. Further activities needed and a respective project proposal are annexed.

(vii) There is a need for immediate programmes, projects and measures in order to mitigate environmental problems and to provide guidelines for environmentally sound development. Such activities, however, must be initiated and coordinated by the Department of Environmental Management yet to be established. They should include the following:

- Integrated Disease Vector Control Programme
- Ecologically Sound Range Management Strategy
- Propagation of Fuel-Efficient Cooking Stoves
- Guidelines for Environmentally Sound Agriculture in the Juba Valley
- Environmental Monitoring Programme.

ANNEX 14 / APPENDIX

Recommended Programmes, Projects and Activities

Recommended Programmes, Projects and Activities

The various JESS reports indicate programmes, projects and activities needed to mitigate adverse impacts caused by the Bardheere Dam Project and to assure environmental soundness of development of the Juba Valley. The recommended measures would serve as a basis for future environmental management in the Study Area.

The following recommended programmes, projects and activities represent only those measures immediately needed in order to solve some of the most pressing environmental issues, in particular to establish institutional capabilities responsible for their solution.

1. Advisory Services to MJVD for the Establishment of an Environmental Management Department

Successful environmental management in the Juba Valley has to be coordinated and implemented by a duly authorized agency. Recommendations were made to establish an environmental management department within MJVD.

The establishment of such agency will require long term advisory services by an environmental specialist at least during the first two years because Somalia lacks such expertise. The foreign expert should assist the Department in executing the following tasks:

- formulation of environmental policies for Juba Valley
- formulation of programmes and projects for ecologically sound resources management
- formulation of programmes and projects for conservation of important, sensitive ecosystems
- design of monitoring programmes of relevant environmental parameters
- development of guidelines for environmentally sound project design, appraisal, implementation and operation (environmental impact assessment)
- on-the-job training of the local counterparts
- organization of short-term and long-term training courses.

The project should include, in addition, advisory services from short-term advisors where needed and financial support for procurement of some basic equipment (computer, monitoring equipment, reference materials etc.).

2. Integrated Disease Vector Control Programme

Effective disease vector control will be a basic prerequisite to substantially improve the health conditions of the people in the Juba Valley. Existing programmes are dormant, resources of the responsible ministry are far too small to show effective results and an integrative approach i.e. employing all physical, biological and chemical means of disease vector control, is lacking. Environmental implications of certain control measures have not been considered in the past.

To prepare an ecologically sound disease vector control programme more in-depth analysis will be needed with respect to the following information:

- analysis of existing policies and legislation with respect to disease vector control

- in-depth analysis of existing programmes and projects, administrative responsibilities, administrative capabilities and constraints

- literature survey assessing applicable means of disease vector control including costs.

Based on thus information a strategy and a long-term programme would be developed including the following components:

- an applied research sub-programme

- a disease vector monitoring sub-programme

- a disease vector control sub-programme further subdivided into
  . mechanical control
  . biological control
  . chemical control.

Preparation of the programme would require advisory services by two consultants, one preferably an ecologist experienced in disease vector habitat ecology, the other one in the management of integrated disease vector control programmes in tropical countries. The consultancy should be conducted in 1989 when the results of all JESS studies are available. Based on the information obtained the consultants would be responsible to design the programme, make estimations of budgetary requirements for a first phase and recommend organizational structure, implementing agency as well as coordination with other programmes and institutions.

3. Guidelines for Environmentally Sound Agriculture

Agricultural practices may contribute to enhance environmental quality for example through strip plantations of trees, soil improvement by mulching, integrated plant protection instead of application of pesticides only, application of organic fertilizers etc. Such practices will not only improve environmental quality but may substantially increase crop yields. Existing projects were not designed or run to achieve these results. The Bardheere Agricultural Experimental Station, eventually funded by EEC would provide an excellent opportunity to undertake related field research works in order to develop respective guidelines. Depending on the principal acceptance of the donor and the MJVD it is recommended that a programme for research and guidelines development be designed and implemented. This programme should include dryland farming which in the past has found only limited attention. Proper coordination with other agricultural research stations in the country will be vital. The programme to be prepared should include the following contents:

- applied research on the impacts of strip plantations along irrigation canals and fields in order to improve the microclimate and to provide fuel wood and fodder
- investigations on the social acceptability of propagation of fruit and shade trees
- investigations on suitable organic fertilizers and their acceptability to local farmers
- investigations on suitable soil improvement techniques (e.g. mulching) and their acceptability lo local farmers
- development of an integrated plant protection programme
- investigations on diversified crop production whose residues may be used as fodder for livestock.

4. Propagation of Fuel-Efficient Cooking Stoves

The Project AS10 National Woodstove Development should be expanded in order to cover the refugee camp sites where severe denudation of vegetation due to overextraction of firewood is apparent. The MJVD should initiate and coordinate a measure targeted at propagating the cooking device in the refugee camps. Apart from the institutions mentioned coordination and contribution of relief organizations and involved NGOs are advisable. Costs should be kept low by this approach.

The project should be conducted by local consultants with experience in producing and promoting simple, energy saving cooking stoves. Estimated investment costs would be about SoSh 2 million and recurrent costs would amount to SoSh 2.5 million.

5. Mitigation Programme Related to Bardheere Dam

The various JESS reports recommend mitigation measures needed to mitigate adverse impacts caused by Bardheere Dam. They do not, however, address their implementation, no cost estimations are provided and the question of institutional responsibilities has still to be resolved. In order to include costs involved in the budget of the Bardheere Dam Project, cost estimations have to be made with respect to the recommended mitigation measures as a basic prerequisite for their implementation.

It is therefore recommended to design a mitigation programme, to calculate necessary budgetary requirements, to identify institutional responsibilities for its implementation and to provide guidelines for compliance monitoring. This programme has to be properly coordinated with other proposed programmes, projects and measures. It is important to note that such programme will depend on the organizational structure of the MJVD yet to be decided upon.

6. Conservation Programme

Up to now many proposals have been made with respect to conservation in Juba Valley (JESS, Technital etc.). A coherent conservation strategy, including preservation of significant and typical habitats (gallery forests, desheks, wetlands, bushlands, dunelands etc.) however, is still lacking. Based on such strategy a conservation programme should be developed and implemented as important component of the Masterplan.

The programme should include the following components:

- evaluation of existing proposals for conservation in Juba Valley
- evaluation of the various studies on vegetation and wildlife
- assessment of existing protected areas with respect to their ecological significance and to their management
- design of a conservation strategy based on the information mentioned above
- development of a conservation management programme based on the conservation strategy and a pertinent work programme
- implementation of the programme.

7. Environmental Monitoring Programme

An effective environmental policy must be preventive. This requires data and information on environmental quality in order to timely recognize trends and changes calling for action. Quantitative monitoring of certain environmental parameter, therefore, will be an essential part of an environmental management plan for Juba Valley.

The following components are necessary for a first phase of an environmental monitoring programme:

- Water quality monitoring
  . river water quality monitoring
  . drinking water supply monitoring
  reservoir water quality monitoring

- Water quantity monitoring

- Land use change monitoring

- Ecological status monitoring
  . wildlife census
  . ecological status/degradation of rangelands
  . reservoir limnology

- Soil quality monitoring
  . salinisation in irrigated lands
  . soil erosion and degradation in dryland farming areas

- Health monitoring
  . health status monitoring
  . disease vector infestation monitoring.

Apart from those parameters many other factors (infrastructure, services, agriculture, livestock) are of environmental relevance. Not all factors mentioned will be monitored by the environmental authority, for example health related parameters which will be monitored by the Ministry of Health. The environmental authority will however be responsible for coordination as well as recommending standards and methods to be used.