DEMOCRATIC REPUBLIC OF SOMALIA

JUBA RIVER VALLEY DEVELOPMENT STUDY

VOL. I

SUMMARY REPORT

TECHNITAL S.p.A.

INTERNATIONAL GENERAL ENGINEERING

OVERSEAS BRANCH-ROME

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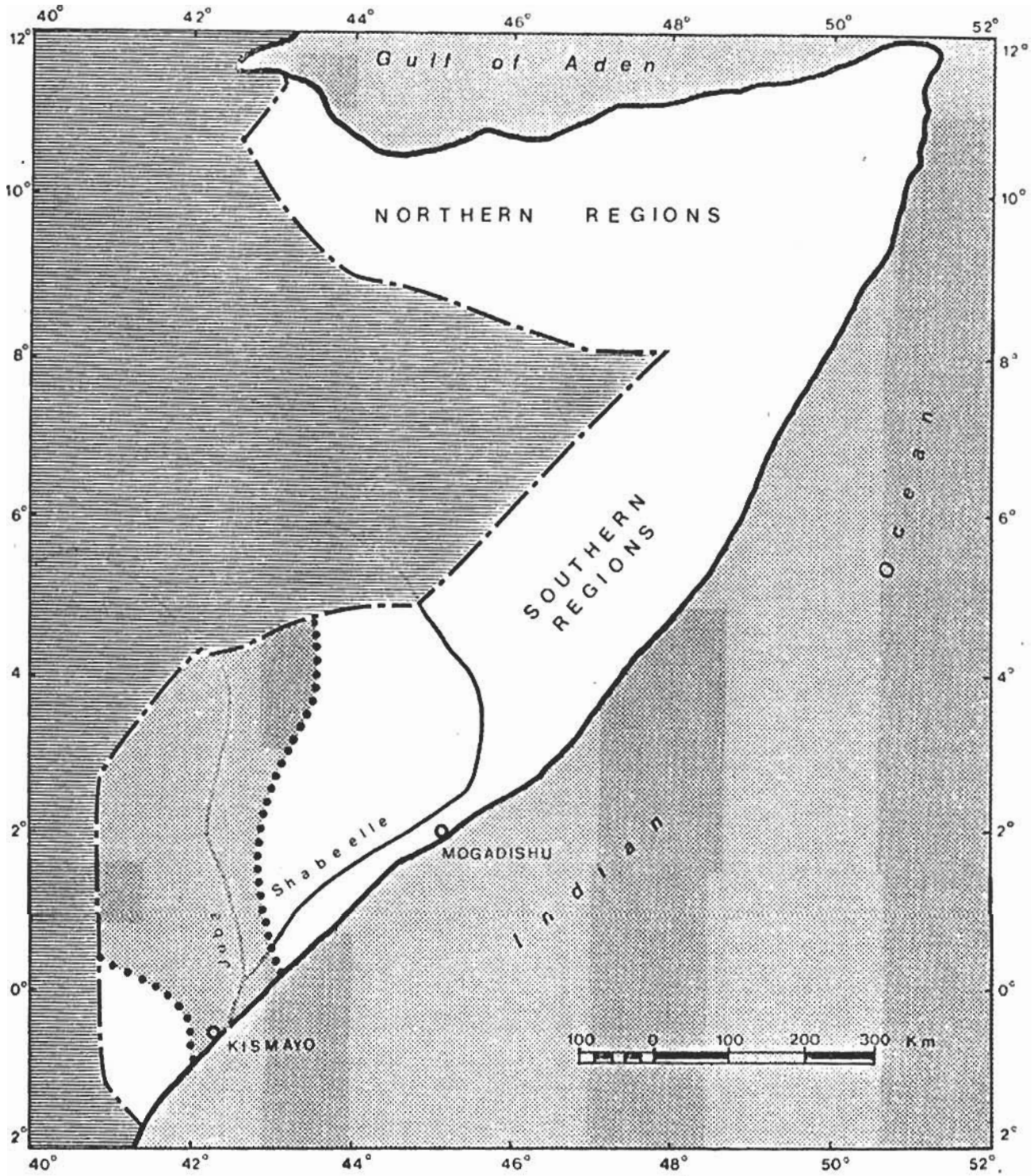

THE PROJECT AREA

L'AREA DI PROGETTO

PREFACE

1. This report details the results of more than one year's study conducted by the "Divisione Estero" of Technital, S.p.A. (which has had independent status since August 1975 and now goes by the name of Technosynesis S.p.A., Planning and Engineering Consultants).

The report consists of six volumes. The first of these, the present one, summarizes all the investigations and conclusions, which are detailed in the other five volumes together with relevant documentation and explanations.

2. Attention must be drawn, at the very outset, to the lack of basic detailed information on the region, especially as regards its topographic, geological and demographic features.

Strange though it may seem, there is still no proper map coverage for most of the Valley. The only documentation showing elevations is the Italian Military Geographical Institute's 1:1,000,000 map dating back from the beginning of the century, and as this was plotted by very approximate methods, it is of no real use for technical purposes. Every effort has been made to make good this lack by various means, the most important being the partial plotting of the 1:60,000 photographic coverage, albeit without any ground control. Extensive land surveys have also been performed in the areas of vital interest. The maps thus obtained have enabled the planning and programming goals to be reached. Though the maps produced may still be insufficient for actual design work, they have enabled us to sweep away much of the conjecture which, for 30 years, has surrounded the possibilities of certain major engineering works.

The situation in the geological sector is much the same, current knowledge being extremely scarce. The new information acquired is again sufficient for the planning phase, but not for the design, yet it has certainly helped to move the approach from the conjectural to the technical hypothesis level. A certain number of doubts remains unsolved, specially concerning the irrigability of certain lands.

3. A major project constraint is the "development model" adopted by Somalia. The country has rejected the "neo-colonial" model, both because of the political choices which have been made and also for precise historical reasons and because of the country's geo-economic characteristics.

The terms of reference of the assignment do not extend to cover the question of political choices, but great confusion would ensue if planning solutions were proposed which are not in keeping with the country's political guidelines. If these are not respected, the schemes suggested would be decidedly inefficient.

This constraint did not emerge during the Brussels discussion of the preliminary Report. That is why the point must be made here, even at the risk of appearing pedantic.

Rejection of the approach which involves the international division of work does not signify that the country is economically self-sufficient. Indeed, it is clear from our approach that exports will have to be increased in order to find the means for paying for imports of necessary capital goods. The Report also draws attention to the advantages of favouring foreign investments in sectors compatible with the development model chosen.

Though the "international price" parameter has not been used in the calculation of economic viability, this does not mean that the principle of

viability is rejected. Indeed it is obvious that this has guided the choice of specific projects. However, the prices and costs in a planned economy are political choices and are basic instruments in the planning policy itself.

4. The advantages of two major hydraulic works, among the many proposed, and the priority nature of these emerged clearly during the course of the study. Without wishing to exceed our terms of reference, which are essentially those of planning, in the case of the two schemes in question (Baardheere and Saakow Dams) certain design aspects have also been looked into.

5. The study was led by the Divisional Manager P.G. Cannata, the Head Economist L. Coccioli and the Head of Techincal Services D. Fanciullacci. Together with those responsible for individual sectors, these experts formed the Technical Board for the project.

The individual sectors of the study were covered by the following technical personnel and experts (in alphabetical order):

Aru A.	Pedology
Cannata P.G.	Planning
Cantalamessa G.	Human and Social aspects
Cesaretti C.M.	Agricultural economy
Cicogna M.	Livestock
Coccioli L.	Macroeconomy (head of economic sector)
De Beni D.	Land surveying
De Rossi G.	Economic and financial feasibility
Fanciullacci D.	Infrastructure
Fuganti A.	Geology
Giuliano G.	Hydrology
Iamalio A.	Hydraulics (head of engineering sector)
Manzo F.	Resident engineer
Miniussi G.	Hydrogeology
Principe I.	Macroeconomy
Rossi M.	Agronomy
Sestini F.	Agronomy (head of agricultural sector)
Venuti R.	Hydraulic engineering.

Mr. Iamalio, an official with the Italian government, gave his services free of charge.

In all, twenty three experts have visited Somalia, four of them on two occasions.

6. The final edition of this Report and the relevant graphics were achieved under the supervision of C. Gregorio and C. Reggiani.

7. It seems almost gratuitous to place on record the cooperation, enthusiasm and friendship demonstrated by the Somali authorities, as well as by colleagues and common folk in all parts of Somalia, both in Mogadishu and in the bush. In such a stimulating atmosphere the authors of this report have felt themselves very deeply involved in the problems of this country from the human standpoint. These few remarks will perhaps explain the lack of impartiality which may be apparent in some of the postures adopted.

Sincerest thanks must also be extended to the authorities and officials of the European Development Fund in Brussels and Mogadishu for their full and continuous assistance.

CHAPTER 1.

THE JUBA VALLEY

1.1 PRESENT ECONOMIC AND SOCIAL SITUATION

1.1.1 Human and social aspects

Foreword

The basic social problem of the Juba Valley Development Plan, taking account of the anthropological-cultural component, centres around the general theme of the coming together of traditional society and modern nationhood.

If this cultural encounter takes place in a "habitat" of penury, the options opened - as far as the social measures are concerned - tend to be restricted, so that it does not seem, from the anthropological point of view, that many alternatives exist to a system of political-social intervention of "total" population mobilization, of a "direct", "unitary" and moderately "centralized" type.

Within this system the possibility exists, all the same, of differentiated conceptual analyses and operative syntheses.

Elements of social development

The elements of conceptual analysis should concern:

a. The demographic aggregate as a front of attack for modernity, the importance of spatial location, traditional or modern, in the dynamics of change.

The importance of human encounter for cultural communication and spread cannot be denied. One of the environmental elements which has always conditioned backwardness of cultures has been geographical isolation, a low density and a scattered population. It is clear that the modernizing of a traditional society, by way of human contact, finds its basic point of attack in settlements which, while not necessarily having to achieve very dense concentrations, have to permit the swift spread of the cultural stimulus and response. The settlement programme for nomadic families will be all the easier, if these settlements have the right dimension and are characterized by the principle of the settlement aggregate as a front of attack for modern statehood. New urban settlements - rural centres or traditional villages - can fulfil a threefold function of renewal in the Valley: in addition to facilitating the communication and spread of new models more in keeping with the political reality, they will permit the concentrated observation and hence knowledge and therefore the permanent criticism of the reactions of encounter. Lastly, they will establish a localizing of contact, through links of relationship or of agnatic affinity, between those population groups who are more contrary to renewal and who segregate themselves in peripheral areas, and the operative sectors of the modernization process present among the settled.

b. Structure and nature of decision-making centres, viewed in the sense of guaranteeing state modernity and compatibility of decision-making and participation.

In traditional culture, especially among nomads, there is a very pronounced equivalence, in the idea of power, between authority and the headman. In the modern state, power and authority tend to be identified with function, and personal status and role are subordinate to this. It is not impossible, in fact, for the older members of certain sections of the population to attribute a political delegate or an administrative official not so much with the identity of state-delegated representative for a political or administrative function, as with being a person in himself having the right of arbitration, i.e. possessing this right by his own prerogative.

The modernizing function of collective decision-making centres is unquestionable because, in creating a situation of confrontation with the central, bureaucratic power, it lends itself to criticism and to democracy. Nevertheless, for the person required to make a collegial decision, it is his intrinsic suitability for the function and the role which attributes a status, and not vice versa, as in traditional usage.

c. Ideology and the political party, the generation factor and the formation of the "class" as carriers of popular participation and guarantee of modernization.

In countries undergoing rapid transition, ideology and the single political party are two powerful factors in modernization, and therefore these two basic components will be assigned the success of the social Development Plan for the Juba Valley. It is indeed ideology which, connected with the choices of economic development, expresses the historical reasons for the need for change (through unitary themes and symbols), because it explains the reasons for technical and economic backwardness, exploitation, the responsibilities of colonialism, of dependence, etc., and as a force of unification and of clarification, it is able to press through the unity of the nation over and above particularisms of a various order; and it is the political party, moreover, which, defining the modern state, guiding the country's economy and formulating the development plans and plans for productive reconversion, organizes the will to restructure social relationships.

In another aspect the political party, the single party, whose foundation is an extremely delicate political moment and calls for the right occasion and careful handling, finds in the activity of mobilizing the people for a development plan those premises of factuality, of reflection, of criticism, of maturity and of executive training (especially of intermediate level) able to guarantee a deep, real bond with the people, the only guarantee of participation and of success of the modernization process.

The most important factor in the formation and consolidation of a leading popular and national class, the necessary and sufficient condition of modern statehood, is the generation factor.

In the Juba Valley there will be over 1,200,000 Somalis, men and women, between the ages of 15 and 45, who during the 25 years of political and social struggle for the economic and social development of the Valley will certainly have attained a high level of unitary awareness and capacity of participation.

The measures

Social measures in the Juba Valley Development Plan may be suggested within the framework of the following model. The range of options remains open; however, as anthropological-cultural theory and observation view the choice of the total and "direct" mobilization of the human resource as not very flexible, if it is wished to achieve the aims of modern statehood, these options cannot be looked upon as substantially very wide. Greater alternatives may perhaps be offered, within the framework of the qualitative indications proposed, by the time and population parameters, and those of operative, political and economic structure.

a. The relation between structure and culture

The most persuasive argument regarding the cultural change it is intended to bring about with the Juba Valley Development Plan pertains to the structural reform sector. In fact, as has already been noted, the interdependence of change between the level of relations for production, and the socio-cultural level of the perception of relations and of "social consciousness", whence in all cases it is not possible to generalize, is all the closer, the more the margins of choice of a development policy are reduced by limited material resources. Historical reality demands that the historic void inherited from the past be closed in as short a time as possible.

b. Action Units of Volunteer Pioneers

These are collective youth formations with specific political tasks of social service, inserted organically in the community social structures and of the people's operative and territorial mobilization in the Valley. Placed thus in the service of the local populations, they are engaged in a permanent activity of constructing modern statehood. These formations will exert from within the organizational and action measures of a political formation, so that they must virtually act as the nucleus of ideological formation of the future intermediate executives of the Single Political Party.

c. Militarized Workers' Brigades

These are the potential in reserve and for purposes of manoeuvering as permanent workforce to be used, in a ten-year cycle in the period of maximum construction of the preliminary civil works and for the infrastructures for production and for services, connected with economic reconversion and the new settlements, and to fill any "voids" in ordinary economic activity in the starting-up and consolidation phase of the reform.

Therefore the establishment of these Militarized Workers' Brigades is tied in with three socio-economic and demographic factors in the Development Plan: 1) the timely carrying out of the basic works; 2) immigration and settling of 300-400,000 nomads from other regions of Somalia stricken or threatened by drought who, on their arrival, must find a minimum of territorial organization; and 3) the final reconversion of the Valley which entails going over to agriculture and the permanent settlement of a large part of the nomads of the Valley and for whom the preparation of a minimum of productive infrastructure and services will have to act as an incentive for change.

A specifically economic reason suggesting the setting up of these Workers' Brigades, moreover, is the need to use to the utmost the labour factor so that, in a situation of labour surplus, the costs of production of the environmental rehabilitation works may be lowered.

Lastly there is an interesting consideration of a general, anthropological and political nature: that is to say, this will be the means of inducing a modern class formation able to bring about a collective productive function, in around 200,000 individuals of the second generation, otherwise destined in large measure to go on living with the subjective appeals of the past culture.

The Towns of the Renaissance and their evolution

The present settlements in the Juba Valley based on the emergency plan to meet the consequences of drought, afflicting thousands of nomadic families in vast areas of the country, will graduate from the present emergency phase and take on a non-episodic character, becoming the very demographic bearing structure of the Juba Valley Development Plan, and the primary aspect of the modernization of the state. The progressive but generalized settling of the nomadic herders appears in fact, from various points of view (historical, social and cultural), to be the basis for the solution of the nomadic economic crisis and of the crisis of its structure of relations, for the reinversion of the economy and an organic development.

With regard to economic development, the urban settlements along the Juba Valley: 1) will help to break the area's present territorial isolation; 2) will be able to absorb the envisaged population growth in integrated urban contexts, as the requisite support for economic development; 3) will make it possible to modernize in a global sense those populations whose nomadic ways condemned to isolation and hence to cultural backwardness; 4) through cultural exchange, they will bring about the formation of citizens that are different from traditional type, able to conceive and actuate a social relation in keeping with the establishment of modern statehood; 5) they will have a balanced urban effect and will therefore bear the brunt of the flight from the land; 6) they will de-congest the administrative and tertiary apparatus in general of the capital, the present growth of which causes unproductive and marginal social "jacs"; 7) they will enable the maximum use to be made of urban and settlement structures, at relatively low costs, exploiting the climatic resource and traditional building techniques.

Connected with the emergence and the evolution of the "renaissance" towns there is a model of successive development phases of the Plan, whereby the various stages of construction may be referred to the social, demographic, socio-economic, socio-cultural and urban planning dimensions.

1. Emergency phase (already partly in being).
2. Phase of consolidation and progressive reduction of the emergency situation.
3. Start-up phase of the large-scale hydraulic works for land and road preparation.
4. Multiplication phase of the renaissance towns (parallel to phase 3).
5. Phase of continuation and completion of the large-scale hydraulic works, and land and road preparation (parallel to phase 4).

6. Phase when the new irrigation works come into service, with the intensive reconversion of agriculture and the structuring of settled stockraising (continuation of phase 4).
7. Restructuring phase for the productive social pattern.
8. Start-up phase for the final urban and/or territorial system, or modified system, and/or the correction of the system (continuation of phase 4).
9. Phase of functional furtherance of the technico-economic and technico-social system of the Plan (continuation and conclusion of phase 4).

Every Renaissance Town will be an urbanized system constituted by an urban centre, rural centres and villages, either newly set up or traditional, i.e. those already inhabited by settled farmers. The urbanized area will, tentatively, be of the following dimensions: the urban centre, rural centres and villages will cover a diametrical extent of about 24 km; the distance between the urbanized areas of every single Renaissance Town will not be more than 12 km; and no rural centre or village will be over 12 km from the nearest urban centre.

In all for not fewer than 10 and not more than 14 Renaissance Towns, the area to be urbanized in the Juba Valley during the period of execution of the Plan will measure approximately 24,000 km^2 and at all events not less than 17,000 km^2.

e. Cooperatives

In the organization of production, especially in the start-up and initial consolidation phase, encouragement must be given to cooperatives between individual agricultural units and stockraisers engaged in direct operations. The cooperative, in fact, from a social point of view must be considered the intermediate economic structure for the progressive approach to state collectivized production run by modern entrepreneurial methods. The task of the cooperatives will also be - in the distribution of the workforce according to the different agricultural and livestock systems - that of permitting a seasonal supply sufficient for crops with a non-continuative working cycle (where the reconversion of the economy will have given rise to very large public farms growing a single crop) which are not able to be fully mechanized. Cooperation of first and/or second degree, in agriculture, in stockraising and also in supplementary and service secondary activities, while at anthropological level permitting the coordinated reduction of economic particularism (the solution whereof is tied to the generational human factor), at production level will in the initial periods give the possibility of an option as to type of operation and further, in time, a good supplementary output for direct consumption.

f. State farms

In the economic field, state farms will have to be progressively assigned the dominant role of the reconversion of the economy of the Juba Valley, which is a necessary condition for full social development and enhancement.

It is in fact possible for the State run unit, as well as having

greater capital availability, to have a proper economic dimension, greater productivity and the use of more advanced technologies. Its vanguard economic role will exercise a modernizing function in direct proportion to its capacity of persuasion as to the techniques of management and of relation for production. The State run unit in all productive sectors will have the structural and anthropological function of creating a "class" and a class consciousness which, as already stated, are the essential condition of modern statehood.

g. The Unitary Decision-making Centre and the structures of study, observation and control of the Juba Valley Development Plan

The success of the Plan, by and large and in toto, calls for a relative autonomy in making decisions, unitary management and coordination, maturity and timeliness of orientation, swiftness of response in adjustments, capacity of effective modernization, by means of real and not just formal popular participation in a united effort. For these reasons it is necessary to establish a Unitary Decision-making Centre during the implementation of the Development Plan.

Furthermore, to achieve a system of "self-regulated" change it is necessary to set up an extensive system of centres of permanent observation of study and systematic processing. These must work by sector, but not be sectoral, and hence be integrated.

1.1.2 Regional and economic characteristics of the Juba Valley

	Year	Somalia	Juba Valley	% Somalia	Catchment area	% Somalia
1. Area (km^2)		638,000	170,720	27	107,120	17
2. Population	1975					
- Total		3,075,000	819,000	27	417,000	14
- Urban		625,000	120,000	19	70,000	11
3. Labour force (units)	1975					
- Total		1,245,000	342,000	27		
- Traditional sectors		1,006,000	318,000	31		
- Market sectors		244,000	24,000	10		
4. Employment ascertained (units)						
- Private sector	1971					
- Total		45,704	4,299	9	2,490	5
- Industry, building, etc.		9,618	644	7	493	5
- Trade		26,974	2,672	10	1,640	6
- Transport, services, etc.		9,112	983	11	357	4
- Public sector	1972					
- Total		35,273	2,808	8		
- Autonomous agencies and joint ventures		17,511	1,152	6		
- Ministries and departments		14,014	1,167	8		
- Municipalities		3,748	489	13		
5. Agricultural products delivered to ADC stockpile (100 kg units)	1973					
- Maize		611,698	84,513	14	81,868	13
- Sorghum		404,352	258,610	64	80,643	20
- Sesame		117,689	16,451	14	16,313	14
6. Livestock (units)	1975					
- Cattle		3,000,000	1,500,000	50	1,200,000	40
- Sheep and goats		10,000,000	1,000,000	10	700,000	7
- Dromedaries		3,000,000	900,000	30	500,000	17

	Year	Somalia	Juba Valley	% Somalia	Catchment area	% Somalia
7. Animals slaughtered in public abattoirs (units)	1972					
- Cattle		156,583	59,989	38		
- Sheep and goats		347,519	16,814	5		
- Dromedaries		43,618	8,753	20		
Industrial structure	1973					
- Local units		271	24	9		
- No. of employees		7,394	865	12		
- Average size of local units		27	36			
Education (school year)	1973/74					
- No. of schools		449	96	21		
- No. of classes		2,860	448	16		
- No. of teachers		3,482	494	14		
- No. of students		107,403	16,457	15		
- Population reached by Ololaha		1,788,855	639,853	36	337,920	19
10. Health	1973					
- No. of hospital beds		5,387	539	10		
- No. of medical staff		1,046	156	15	81	8
. Customs duties collected at points of entry (000 So.Sh.)	1973	289,389	9,415	3	9,415	3
. Private banking transactions (000 So.Sh.)	1972					
- Deposits		269,071	20,618	8		
- Loans		403,082	8,137	2		
13. 1968 data						
- Urban population		540,600	67,100	12		
- Rural population		138,810	16,490	16		
- Income of urban population		803.9	82.4	10		
- Per-capita income		1,490	1,230			
- Value of production		1,178.4	194.8	16		
- Rural production						
- Total		374.5	112.4	30		
- Agriculture		139.9	74.3	53		
- Livestock		234.6	38.1	16		

Source: Technital estimates

1.1.3 The Present Economic Situation

Very broad estimates based on available data put the Somali gross national product at about So.Sh. 1,500 million, of which 80% in the form of traded production and the remaining 20% as traditional agriculture.

The industrial sector accounts for some 16% of the total, and modern agriculture probably represents about one quarter of the national product.

These income pointers are of little significance in an economy such as Somalia's, where traditional, non-monetized sectors co-exist with modern sectors. However, it is worth noting that per capita income ranges from 1,600 shillings a year in the modern sector to 150 shillings a year for the people in the traditional sector (based on estimates of products consumed by those concerned).

It is thought that the present total income of the Juba Valley is around So.Sh. 260 million i.e. a little more than 17% of the national product.

Although these estimates are for 1968, they do provide fairly cogent indications on the structural relationships of the Somali economy and the relative territorial weights involved, as the relationships have not changed greatly over the intervening period. This is certainly so where the Juba Valley is concerned, since marked modifications will only be possible here after the implementation of an organised development programme based on exploitation of the huge land and water resources.

Since 1960, Somalia's trade deficit has been steadily deteriorating. Over the last four years, the decline has been more marked, running from around So.Sh. 200 million in 1971 to a little over So.Sh. 500 million in 1974, when it represented around one third of the GNP.

However, the agricultural trade balance has been positive over the same period, rising from a little more than So.Sh. 60 million in 1971 to around 190 million in 1974. Cereals and sugar account for the bulk of agricultural imports (over 60% of the total), while agricultural exports consist essentially of livestock (59%) and bananas, (25%).

At the present time, to cope with the food demand difficulties, especially as regards cereals, the Somali authorities have a compulsory purchase scheme for basic products, so as to exert control over the system at the production, distribution and trade levels. The products covered by the scheme are cereals and oilseeds. The prices of these are fixed by the Agricultural Development Commission (ADC), which also exercises control over the various phases between production and consumption.

The ADC purchases the product directly from the farmers, through 147 collection points (60 of which in the Juba Valley). The products are then transferred to 25 centres which have a total stockpiling capacity of around 1,000,000 quintals (1), one third of which is located in the Juba Valley. From these centres the product is channelled to the consumer via the District Trade Agencies.

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(1) 1 q. = 100 kg; 10 q. = 1 metric ton

The price policy adopted is framed to promote production and to get the products into the stockpiles, the prices paid generally being higher than those offered previously by private traders. Current legislation requires controlled products to be sold to the state, the growers being allowed to keep the equivalent of 100 kg of cereal per capita per year for family use. Prices are subject to change, as occurred during the recent drought.

Percentagewise, the Juba Valley contributes relatively more to exports than it does to the formation of national income, while absorbing a relatively smaller percentage of total imports.

There is a decided dualism in the economic structure of three of the valley regions, Jubbada Hoose, Dujuuma and Gedo. Agriculture in the Jubbada Hoose region mainly hinges around cash crops (bananas and meat) and there are the first signs of the emergence of industrial activities (meat canning and the manufacture of packing materials). In the other two regions, instead, agriculture is mainly of the subsistence variety, except for the onion growing industry at Baardheere which serves the urban market, and some cattle raising.

Potential land resources amount to some 220,000 ha, which could be irrigated by water from the Juba. If these were properly used, they could ensure a quantum jump in Juba Valley production, making this one of the country's most important development poles. The 1974 - 1978 Five Year Plan recognises the importance of the valley and gives it high priority in the allocation of public funds, devoting to it some So.Sh. 740 million out of the total planned investment of 825 million. The projects included in the programme, some of which are already being implemented, are:

1. The development of rice growing at Jilib, with annual production of 12,000 tons of paddy rice or 8,000 tons of polished rice, capable of satisfying almost one third of the country's needs.
2. The development of 20,000 ha of irrigated land at Faanoole, for the production of cotton, sesame, groundnuts, maize and pulses.
3. The development of banana growing in the Lower Valley of the Juba and of a pilot farm at Kananji.
4. The development of sugarcane plantations on over 5,000 ha for the production of around 500,000 tons of cane, plus the construction of a new 50,000 tons sugar mill.
5. Project for cotton growing at Jamaame on a 2,400 ha State Farm and the construction of a ginnery.
6. The development of livestock through the Trans-Juba Project and the Multi-Purpose Cattle Ranch at Jilib.

The high priority given by the government for the development of the Juba Valley is apparent from this ensemble of projects. The list also gives some idea of the future contribution the valley can make to the country's economy.

The projects will also help develop the existing and future labour force in the valley, which, it is estimated, has a population of around 800,000 (Lower and Upper Juba) and a labour force of more than 300,000. It is estimated that 60% of this force is engaged in nomadic herding and 24% in agriculture, though the situation has probably changed somewhat after the recent drought, which caused the estimated loss of one million cattle, six million sheep and more than half a million camels throughout Somalia.

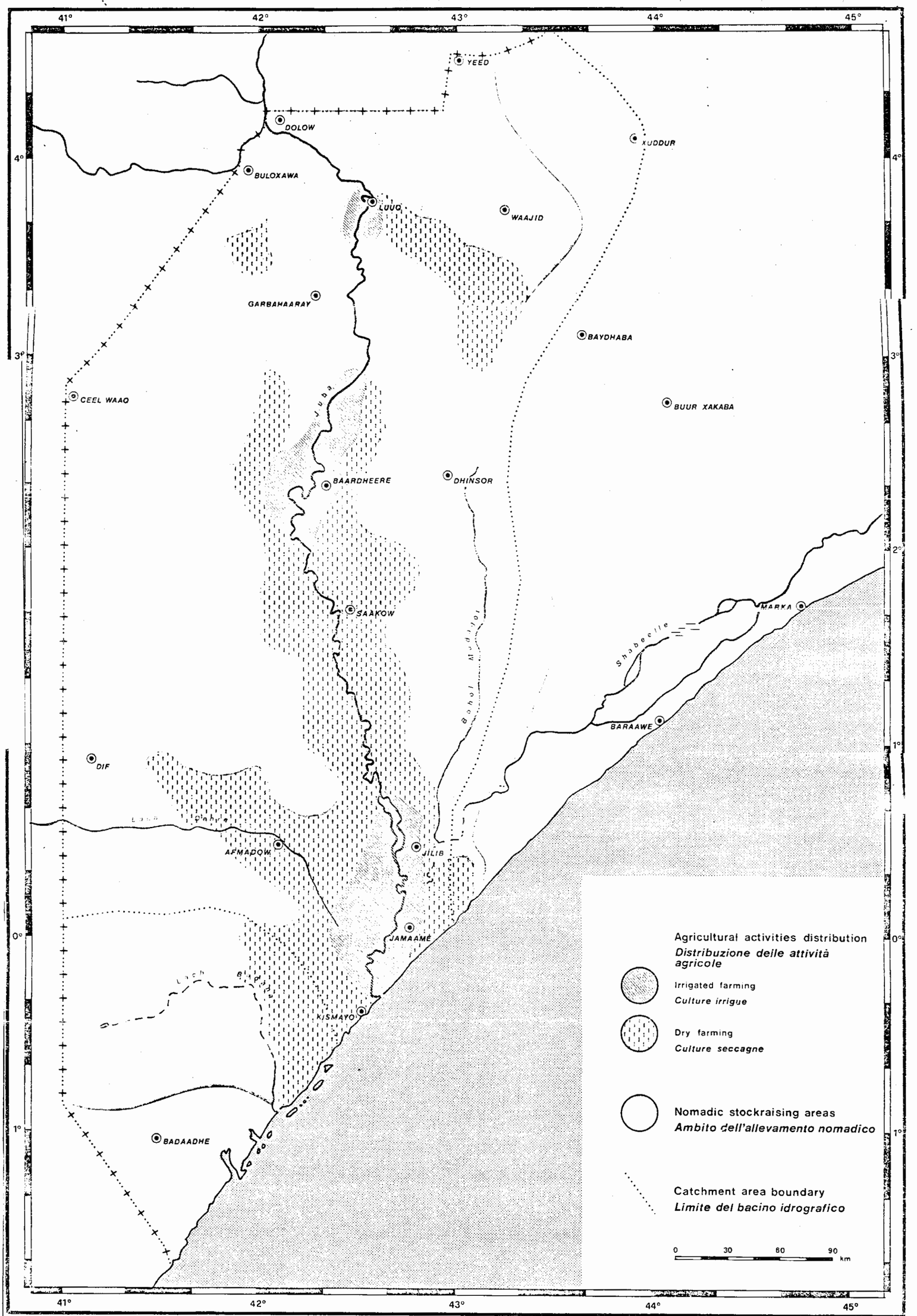


fig. 1

LAND USE | *UTILIZZAZIONE DEL TERRITORIO*

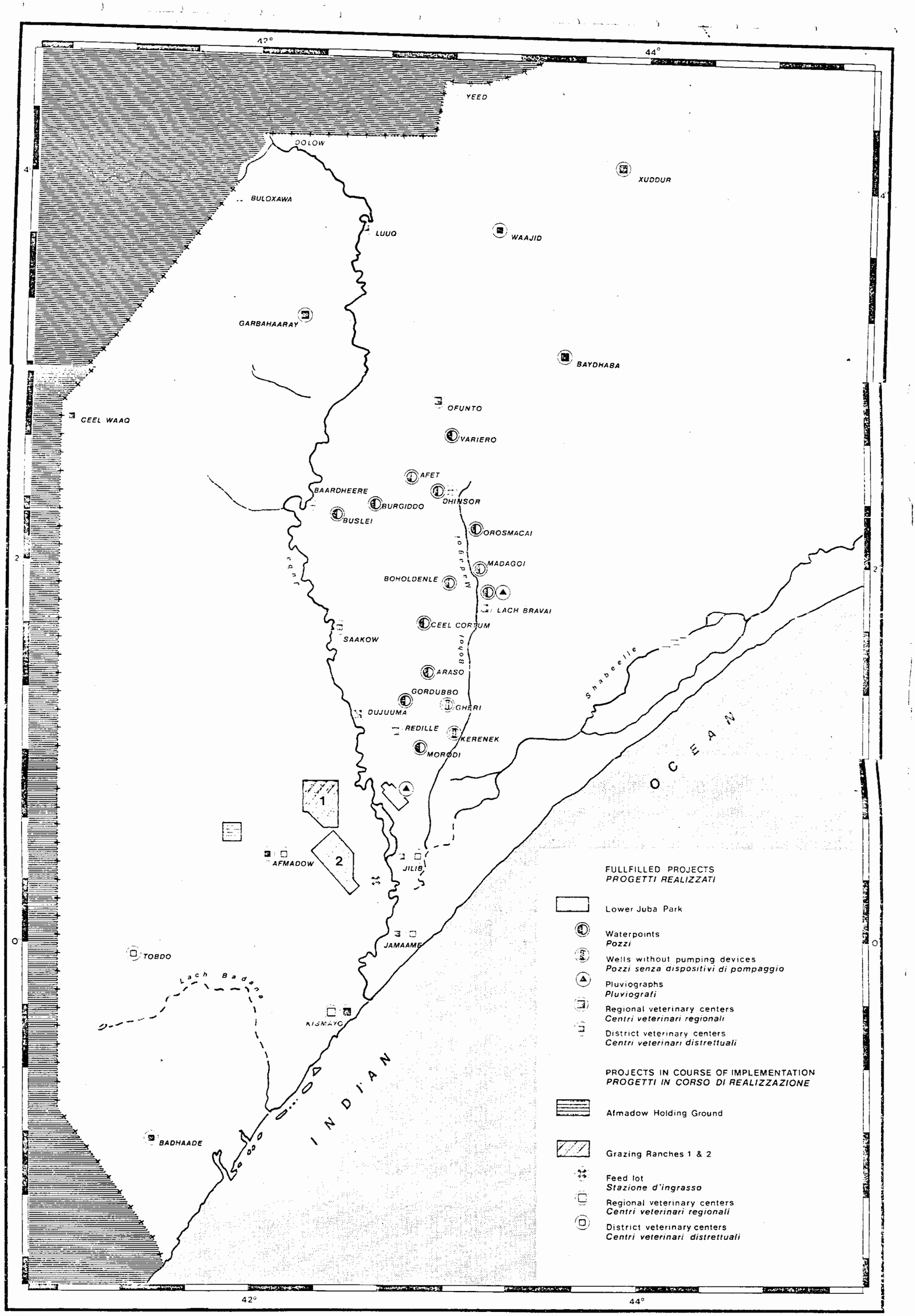


fig. 2

FULLFILLED & ON-GOING PROJECTS

PROGETTI REALIZZATI ED IN CORSO

This calamity provided yet a further stimulus for the Somali authorities to do everything possible to speed up the process of the development of the Juba Valley resources.

The points made in this report are framed to support an analysis of the prospects and of the development potential, though, as noted, there is a serious lack of statistical data and many gaps exist in our knowledge of the region. Thus it is impossible to provide a more detailed picture of the structure and economic activities of the Juba Valley than is given here; this is discussed in greater detail in Vol. II - Part I of the Report.

1.2 RESOURCES

1.2.1 Water and the Climate

Description of the river

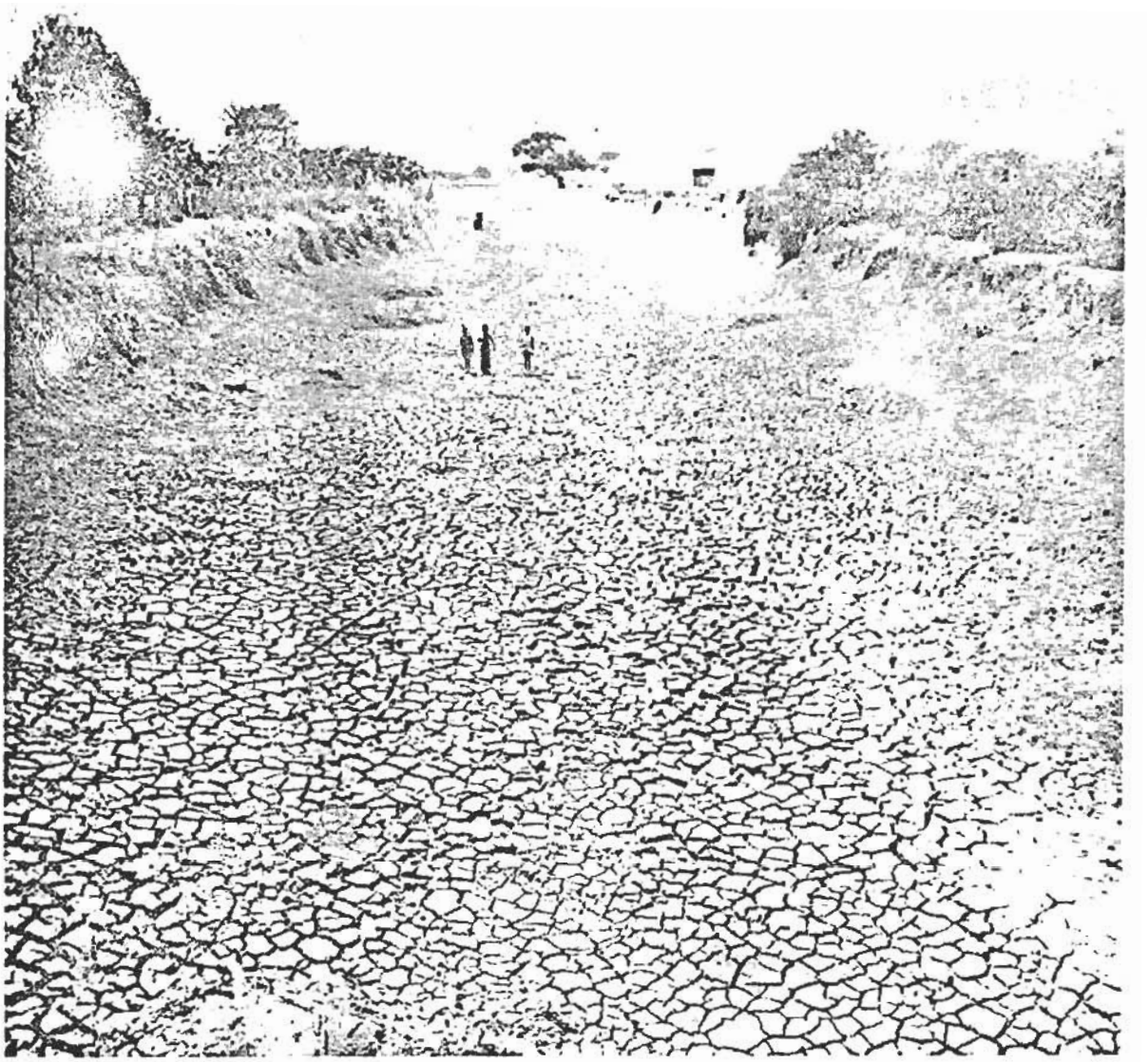
The Juba runs through Somali territory for about 800 km from Dolow to the Indian Ocean. Basically its hydrographic characteristics, which are developed upstream on the southern slopes of the Ethiopian highlands, remain unchanged. The Somali part of the Juba basin amounts to one third of the total area. The drainage network is poorly developed and the Juba has few tributaries, almost all of which are seasonal. Taken as a whole, they bring in little surface water to the Juba, and that only in the rainy season. The tributaries often peter out in natural depressions where water is lost by infiltration and evaporation, thus never reaching the main course.

Near its mouth the Juba is joined on the left bank by the Webi Shebeli and the Bohol Magaday, and on the right bank by the Laag Dheere. These rivers can bring in high discharges on occasions. However, under normal circumstances the waters of the Webi Shebeli are lost in a swampy area behind the coastal dune range. It is only during heavy rains that the waters reach the Juba through a system of natural channels (fartas). The Bohol Magaday, which drains the area between the Juba and the Webi Shebeli, discharges its flood waters into a system of pools (the Harnaga and Tuculle lakes) but sometimes the waters flow right through these, following the fartas together with the Shebeli waters, to arrive at the Juba.

On the right bank the waters which come from the southern regions and Kenya are collected by a system of streams which includes the Laag Dheere. These discharge into the Desceck Uamo without arriving at the Juba itself.

The main channel has a very low, uniform gradient from where it enters into Somali territory at the confluence of the Dawa Parma and the Juba proper, up to where it flows into the sea (in the 0.30% to the 0.15% range). Despite the variable elevations of the surrounding valley land, this uniformity is achieved by the formation of meanders, which are often very marked. In the upper and middle reaches, the river never has more than one channel, but in the lower reaches, it meanders and is sometimes braided.

Shabeelle river great bed during the dry season. The river has a continuous flow and streams down to the Juba only in very exceptional cases. The Juba itself dries up completely for short occasional periods.



The channel cross-section is fairly regular and its size changes little, because of the moderate velocity of the waters and the relatively compact nature of the banks. These are also protected on the surface and at depth by perennial vegetation which, by natural selection, has come to provide an ideal form of defence against the various forms of erosion.

The terrain through which the river flows is however more diversified over large stretches. Upstream are the tabular landforms of the Jurassic cretaceous formations into which the valley is cut for a few dozen metres. In the intermediate reaches it runs between limestone hills, the rock being in outcrop or subcrop. Here the river is entrenched to a depth which varies between the two extremes encountered upstream and downstream. Finally in the lower course there is a vast flat alluvial plain into which the river channel is cut for but a few metres, though the depth is somewhat greater near the coastal dunes. In the middle and the lower reaches of the valley, downstream of Anole, are numerous shallow depressions on both banks (desceks) where rainwaters or floodwaters tend to pond. The desceks are probably remains of a much broader paleochannel which has now moved to its present position owing to the deposition of silt and sand.

Climate

The climate is arid. There are two rainy season, April June and September - November, and two dry seasons, December - March and June - August. Mean annual rainfall in the Juba basin ranges from around 800 mm in the mountains outside Somali territory to 300 - 400 mm on the alluvial plain.

Some 40 - 50% of the annual rainfall occurs in the first rainy season and 20 - 30% occurs in the second. In the mountainous part of the basin the two rainy seasons are separated by a well-defined dry season, but this is not the case on the alluvial plain.

Mean annual evaporation from ponds and lakes is of the order of 2,000 mm with a maximum in the January - March period.

Hydrological characteristics

It is impossible to give a complete evaluation of the water resources and of the hydrological characteristics of the Juba because of the lack of stream gauge data, the level of aggregation of the record available, and in some cases, doubts as to the reliability of the record.

Annual streamflow of the Juba is in the region of $5.5 \div 5.8 \times 10^9$ m^3 according to FAO data, there being only moderate variations along the course of the river. Year to year variability is not marked, values generally being in the range of $3.5 \div 8.5 \times 10^9$ m^3. Streamflow with an 80% probability is around 4.8×10^9 m^3.

Streamflow estimates derived from Selchozpromexport data are somewhat higher than these, the variation ranging from 2 to 20% depending upon the reach of river concerned and the level of probability considered.

Juba flows are very variable over the course of a given year, because they are directly dependent on rainfall. There are two flood-flow periods,

the first in April - May connected with the "gu" rains and the second in August - November connected to the "der" rains which occur in Ethiopia somewhat earlier than in Somalia. Between these two periods flow remains relatively high, the period of lowest flow occurring immediately before the spring floods.

The trend of flows of various durations, measured at the various gauging stations, provide some indication of the distribution of water resources along the Juba.

With the data available, it is not possible to make a realistic assessment of the groundwater contribution to the Juba flows. Between Luuq and Baardheere the discharge increases in the low-flow and normal flow periods, and decreases during the flood-flow period, particularly the "der" floods. The latter effect would seem to be attributable to water spilling out of the channel into depressions alongside the river and to water being stored in porous deposits along the banks. The flow increases instead could well be attributed to the influx of deeper groundwaters to the river channel and to the slow release of water stored in the porous deposits of the banks. (1).

Between Baardheere and Kaitoi the situation appears to be more complex, from the geohydrological point of view. In this reach the discharges tend to increase over most of the year, because of contributions from tributaries during the high rainfall periods, and because of the return to the channel of floodwaters which spilled out farther upstream. Discharge decreases occur only in the driest period and are probably attributable to infiltration.

In the reach from Kaitoi to Jamaame, there is a decrease in discharge throughout the whole of the year owing to evaporation and infiltration, as well as the extraction of water for irrigation. The decrease is particularly marked during the flood periods when the waters frequently overtop the banks because of the insufficient channel capacity.

In the driest period (January - March) monthly streamflow is around 90×10^6 m^3, with minima in the $6 + 8 \times 10^6$ m^3 range. In some regions (e.g. Jilib, Jamaame) exceptional periods with no flow have been recorded.

The highly seasonal behaviour of the river underlines the need for flow regulation in order to develop resources. Leaving aside constraints of an environmental and technological character, conditions for the development of water resources are more or less uniform throughout the Juba. By providing annual compensation it is possible to make available about 60% of the streamflow, while with two-yearly compensation about 80% becomes available.

Floods and the overtopping of the river banks are important features of the Juba throughout its Somali course and are of particular note in the alluvial plain, because of the volume of water which pours out of the channel and because of the amount of land inundated, owing to the uniform lie of the terrain.

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(1) In the past, these phenomena have been interpreted by some in a way which has led them to express doubts on the feasibility of the Baardheere Dam. Indeed, they have considered that the marked loss of discharge could indicate prohibitive seepage. However such conjectural interpretation has been proved unsound by improvement in knowledge of the situation.

Flooding occurs practically every year because of the modest capacity of the channel, 600 - 700 m^3/s compared with the average flood which exceeds 900 m^3/s. Inundations are particularly marked when the Webi Shebeli and especially the Bohol Magaday are also in spate at the same time and pour their waters into the Juba.

The spring floods are short and sharp, while those that occur . . in autumn are less variable and last longer; the flood hydrograph has several peaks. On average it takes the floodwave four days to descend the Juba from Luuq to the sea.

Estimates of the maximum daily discharge with a 100-year return period in the Luuq-Kaitoi reach are around 2,100 - 2,400 m^3/s. The volumes of the 50 and 100-day floods with the same return period are 4.5 and $7.5 \times 10^9 m^3$, respectively, at Luuq station. These values are about 10% higher in the stretch down to Kaitoi.

From the few data available, it would appear that the river carries a considerable amount of sediment, the average annual volume being estimated at $10 \div 12 \times 10^6 m^3$. The material consists mainly of silt and clay, sands amounting to not more than around 8% of the total.

The total dissolved solids of the Juba waters average 200 - 500 mg/l. However this figure rises sharply during the first days of the "gu" floods to even more than 1,000 mg/l. In general, the moderate average salinity and the chemical composition do not appear to indicate that there are any particular constraints on the use of the Juba waters except during this peak period. At that time it would be as well to let the floodwave run to the sea without diverting it for irrigation, i.e. the same principle should be adopted as at present.

While on the subject of the chemical composition of the Juba waters, it should be noted that during the low-flow period there is a particular situation in the reach near the mouth, where a saline cone of seawater is pushed inland by the tides for about 40 km.

Groundwater resources

The following hydrological provinces may be distinguished in the Juba basin. In each of these the aquifers have more or less the same properties:

a. Gypsiferous - calcareous - basaltic plateaux. Here there are three environments, gypsiferous - calcareous, calcareous and basaltic.

Karst groundwaters and springs exist in the gypsiferous and calcareous rocks. Where the groundwater occurs it can be tapped by wells between 5 and 40 m deep. However, the waters are always saline (from 3 - 5 g/l of residue).

Where groundwaters occur in the calcareous rocks they have been found by wells ranging from about 3 - 10 and 20 - 50 m deep. The quality of the water is better than that in the gypsiferous areas, the residue generally being around 1 and 2.5 g/l.

Groundwaters in the basalts occur at depths of 5 - 8 m and 40 - 60 m. Salinity is variable (from 1.5 g/l).

b. The Buur crystallines. Springs are rare here and of negligible importance. Where groundwater exists it is found at a depth of between 8 and

20 m and the TDS is very variable. Some waters are good and some are bad (from 1 - 2 g/l to 18 - 36 g/l).

c. Lower Juba plain. The shallower aquifer (less than about 50 m) generally has very hard water (from 6 - 35 g/l residue), but the water encountered in a second aquifer at a depth from 120 - 180 m is markedly better.

The guidelines for complete investigation of the groundwater aspect are laid down in Vol. III - Parts I and II.

1.2.2 Land with Irrigation Capability

Land classification for irrigation suitability

Differences in the irrigation capability of the Juba Valley lands are attributable mainly to their different geological origins.

For the purpose of the present study (see Vol. IV, Part I), the lands have been classified according to the U.S. Bureau of Reclamation's "Land Classification for Irrigation Suitability". This provides for the lands being divided into six classes, each of decreasing irrigation suitability (1).

The classification has been performed on the basis of existing documentation relative to the study area (2) supplemented by on-site investigations.

The various land classes have been plotted on the sheet produced by FAO, derived from uncontrolled 1:60,000 photomosaics.

Twenty-three sheets were considered: Dolow 13 and 14; Ceel Waaq 12 and 16; Baardheere 1, 2, 5, 6, 9, 10, 13 and 14; Dif 4; Jilib 1, 2, 5, 6, 9, 10, 13 and 14; and Kismayo 1 and 2. The sheets cover a total area of around 70,000 km^2.

The results of the land classification for irrigation suitability are given in Table 1 and are plotted on the 1:200,000 Maps IV,I,2,1 & IV,I,3,1.

As the classification adopted here follows the standards of the US Bureau of Reclamation, the evaluation differs from that made in the "Juba River Irrigation Scheme" 1965. In particular, some of the "solonetz" series have all been put in Class 4 whether or not they have a high salt content, while in the classification done by the Russian experts the series concerned were put in Classes 2 and 3.

This different interpretation and evaluation of irrigation suitability, which takes account of basic economic criteria, has obviously led to diverse results. In general the evaluations given here are pitched on the cautious side.

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(1) US Dept. of Interior, Bureau of Reclamation Manual, Vol. V, Part II.

(2) a. Agricultural and Water Surveys, Vol. III, Landform and Soil, FAO, Rome, 1967.
b. Inter-River Economic Exploration, Washington 1961.
c. The Juba River Irrigation Scheme, Vol. V: Soils, Moscow, 1965.

Table 1 - Land-classification for irrigation suitability

District	Area classified				
	Total	Class 1^	Class 2^	Class 3^	Class (1) 4^
1 LUUQ - DOLOW	33,670	13,198	-	20,472	-
2 BAARDHEERE-SAAKOW	132,490	5,985	126,505	-	-
3 DOWNSTREAM OF SAAKOW (2)	89,940	6,300	4,225	41,055	38,360
4 DOWNSTREAM OF DUJUUMA	20,463	4,087	16,376	-	-
5 DUFALACH-AFMADOW	22,918	-	22,918	-	-
6 FAANOOLE-JILIB	34,021	10,770	4,751	-	18,500
7 TOUTA ISLAND	15,700	10,900	4,800	-	-
8 BAARDHEERE-IONTE	37,900	10,300	27,600	-	-
9 JAMAAME	28,436	16,414	5,330	6,692	-
10 STATE FARMS	13,734	5,133	46	-	8,555
11 DESCEK UAMO	18,740	-	18,740	-	-
Total ha	448,012	83,087	231,291	68,219	65,415
%	100	18.7	51.3	15.3	14.7

(1) The Class 4^lands are included in the districts envisaged in ditto "The Juba Irrigation Scheme" - 1965.

(2) In the "Juba Irrigation Scheme" this is called the Dujuuma district.

NOTE : The area on the Baardheere 14, El Waak 12 and 16, and Dif 4 sheets are not included in this table because they lie farther than 50 km from the river and hence it is considered that the Juba waters cannot be conveyed to them economically by canal.

The results may however be considered encouraging, since they indicate that there is a considerable amount of land in the first three irrigability classes.

Criteria for the use of irrigable land

The natural environment here means that erosion by wind and water is a constant hazard. Eolian erosion is particularly apparent on the sandy formations, while water erosion is intense and widespread throughout the Valley.

Erosion has caused and can still cause irreversible damage over vast areas, and this is always accompanied by a general degeneration of the whole environment.

Both soil and vegetation play a very important role in ensuring the stability of certain areas, as well as satisfying general ecological requirements. To ensure that future use neither causes nor accelerates erosion, it is necessary to adopt utilisation coefficients to ensure that proportionally less Class 3 lands are used than Class 1. Though, equally, it should be noted that not all Class 1 lands can be used for agriculture. Reduction of the luxuriant vegetation which grows along the banks of the Juba (gallery forest and other formations) should be kept to a minimum.

Class 4 lands should be used at least in the initial period for rice-growing to ensure the progressive improvement through leaching. Should they be devoted to the growing of cotton or other crops, it will be necessary to install underground drainage (tile drains), using cement, plastic and other kinds of pipes to impede there is an adequate arable depth and to impede the rise of the watertable and the consequent salinization of the soil.

The erosion hazard in the case of Class 2 lands is greater than that of Class 1 and may become high and even very high in the case of Class 3 and Class 4 lands. Utilisation should not exceed 70 - 90% in the case of Class 1 lands, 60% in the case of Class 2 and 30 - 40% for Class 3.

Certain principles must be rigorously observed in the use of these lands. These are indicated below:

- Tilling

As far as Class 1 lands are concerned and for part of the Class 2 (Reddish Brown Calcic Soils), there should not be any tilling difficulties though there will be problems with the clayey soils of Class 2 and Class 3 (Grumosols). Tilling difficulties increase if, in addition to a high clay content, the soils are rather saline or alkaline.

In all cases these soils must be tilled at a moisture content which favours maximum breakup of the clods, while complete dehydration after tilling should improve the structure. As the years go by, the depth to which the soils are tilled should be progressively increased.

The best results will be obtained from the soils if alkalinity defects are corrected, salts are leached out and organic manure is applied.

- Irrigation

The sprinkler irrigation method is generally to be preferred. However, it is probable that in an initial phase it may be advisable to use surface irrigation, considering the natural and human environment involved.

Forage crops too could be sprinkler irrigated, while orchards with widely-space trees could be trickle irrigated.

In the case of saline soils (or those with a salinity hazard), the irrigation rate should be increased by around 30% to allow sufficient water for leaching.

By way of a guide, the irrigation rates for the individual classes of lands could be as follows:

Class 1	5- 6 m^3/ha/cm	on sandy soils
	10 m^3/ha/cm	on clayey soils
Class 2	10-12 m^3/ha/cm	on clayey soils
Class 3	12 m^3/ha/cm	

- Drainage and Leaching

Apart from some of the Class 1 lands all the others contain some salts and drainage is slow to very slow or even completely impeded in certain cases. It is therefore essential to construct a drainage system. As mentioned, tile drains may also be required, especially where intensive farming methods are to be used. Open or tile drains will serve to control and progressively eliminate salinity, preventing salinisation, increasing the arable depth and impeding the onset of erosion.

As part of the drainage waters will go directly into the groundwater system or finish up in the Juba, it will be necessary to exercise control over the TDS of the river waters.

- Trials and experimentation

There are few experimental data that can be used as a basis for the development of agriculture in the Valley. So trials will have to be carried out in order to obtain reliable information on tilling, manuring and fertilization, improvement of physical properties (especially of the clayey soils) drainage, erosion, etc. But in anycase, precedence must be given to monitoring the waters of the Juba (sediment transport, dissolved salts, SAR, etc.) and to the design and checking of farm-hydraulic systems and layouts, together with the most suitable irrigation systems and methods.

1.2.3 Other Resources

Mineral resources

Very little is known on this subject, though there has been some oil exploration and prospecting for iron, radioactive minerals and laterites in the Juba basin. Some work is still underway. The most complete study, which also summarized all preceding information on these three groups of minerals

is that performed by the UNDP (1970), from which we report some of the most cogent data.

Oil Exploration

Two major parts of the Juba basin are of interest from the oil exploration point of view. The Jurassic-Cretaceous, calcareous-gypsiferous formation in the north and the Tertiary avenaceous and argillaceous sedimentaries in the south and along the coast.

Oil exploration started in the Juba basin in 1957 some 20 years after the first steps had been taken in this direction in Somalia, namely in 1936 in the northernmost part of the country where, as far back as 1911, surface shows of bituminous material had been observed. Between 1957 and 1961 the Frobischer company performed geological, photogeological and gravity surveys in western Somalia, including the whole of the Juba river basin and part of the Shebeli basin too.

Geological, photogeological and geophysical surveys were performed in the coastal area and two wells were sunk near Kismayo. The most westerly well, at Caddo Caalimo (4,466 m deep), was sunk in 1964, while the most easterly one, near Jamaame (4,125 m deep), was drilled in 1964 - 1965. The two wells encountered Tertiary avenaceous and argillaceous formations and were both dry. Since 1969, only geological research has been carried out in the coastal area and no further wells have been planned.

Between 1962 and the end of 1965 the Gulf company had exploration permits for the middle and upper part of the Juba basin. There they ran geological, photogeological and geophysical surveys (magnetometer, gravity and seismic) and sunk two exploratory wells. One of these was a 3,082 m hole at Laag Bisig (1965) and the other a 2,867 m hole at Laag Dheere (1965) about half way between the Juba and the Kenya frontier at the latitude of Jilib. Both holes were dry. They encountered only Tertiary rocks, the oldest formation being Paleocene.

Exploration has been going on since 1966 in the Jurassic and Cretaceous calcareous-gypsiferous rocks occupying the middle and upper reaches of the Juba basin.

The Hammar company made photogeological and seismic studies and drilled two wells in 1969, one at Dasaweyn (3,249 m deep), the other at Geferso (2,180 m deep), lying south-southwest of Dujuuma. Both wells were dry. They encountered only Mesozoic rocks (the oldest formations being Middle Jurassic) similar to those outcropping along the course of the Juba between Baardheere and Luuq.

In 1972 the Burmah company performed seismic surveys and sunk a 4,000 m well at Hol in the upper part of the basin west-south west of Luuq. The dry hole encountered only Cretaceous and Jurassic formations, the oldest being Lias.

The exploration work done is justified by the presence in the Jurassic and Tertiary series of rocks which might be mother rocks, reservoir rocks and cover rocks. Moreover there are reasonably favourable structures in both areas. Although oil has yet to be found, this in no way excludes the possibility of some future wells being successful, the greatest probability of hitting a bonanza being in the Tertiary basin in the coastal and offshore area rather than in the Jurassic basin of the Upper Juba.

Iron Ore

The iron ore deposits are the most interesting minerals in the Juba Valley, though at the present time they cannot be economically exploited. The main outcrops of mineralized rock (known as banded hematite and magnetite quarzites) occur at Buur Qalan and Doymer, in the Buur region between Baydhaba and Dhinsoor. Smaller deposits are found in other parts of the Precambrian Basement Complex.

The potential geological reserves of the Buur Qalan deposit amount to 119,000,000 tons of ore, while those at Doymer are around 48,000,000 tons. The mineralized rock contains from 30 - 40% Fe and from 35 - 50% silica. It can be extracted by open pit methods. The feasibility study indicates that it would not be an economic proposition to develop the two iron ore deposits at the present time (UNDP 1970). However, should the price of iron ore increase in the future and should the areas come to have an infrastructure or other mining and industrial activities, the question of developing these products could be reviewed, and the outcome may be favourable.

Radioactive minerals

Radioactive minerals are also found in the Buur area in the western part of which geophysical surveys carried out during the UNDP project revealed 38 radioactive anomalies. One of the most important is at Caliyow Geele, southwest of Buur Xakaba. The surface part of this anomaly was explored by means of pits and borings by the UNDP mission, whose report details the results obtained.

This is a thorium-rich deposit with a relatively low uranium content. It would seem that the genesis of the mineralization was as follows: dykes of more or less albitized syenite were injected in the Basement Complex amphibole gneisses, then during post - Jurassic times there were tectonic movements accompanied by the circulation of various hot solutions carrying thorium and uranium minerals and other accessories which were deposited in the contact areas between the syenite and gneiss country rocks.

The results of the UNDP mission show that the deposit may be of industrial interest but that more detailed and complete investigation is necessary. This is presently being done by a company of the Italian ENI group.

In view of the homogeneous nature of the geology in the Buur area situations similar to that at Caliyow Geele may well exist. There could well be other anomalies, which could even occur outside the area covered by the UNDP radiometric survey.

Laterites

The UNDP mission also explored for bauxite. The most promising signs occur in the Jurassic argillaceous and calcareous formations near Mannas, not far from Baydhaba. Here, over an area of around 15 km^2, there is an 11 m thick deposit of laterites with ferruginous oolites contained in a colloform material with occasional grains of quartz and finely crystallised carbonates. The colloform material consists of geothite with kaolignite, gibbsite, hematite, calcite and quartz.

Cement

In the upper part of the Juba basin there are limestones, marls, clays, gypsums and anhydrites, all typical raw materials for Portland cement. Many large deposits of these materials occur over the whole territory.

Scenic and wildlife resources

These resources are mentioned in the Projects outline, at paragraphs 3.5.5 and 3.7 of this Volume.

CHAPTER 2.

GENERAL DEVELOPMENT OUTLINE

2.1 DEVELOPMENT AIMS

When dealing with the long-term development prospects of the Juba valley and its possible final social and economic pattern, it must be appreciated that the level of reliability of the processed data and of the projections can be no more than fair, because of two basic weaknesses:

a. The statistical information basis leaves much to be desired; it has thus been necessary to try to improve this by making certain assumptions (all clearly indicated in the text) some of which may be less realistic than others.

b. The 30-year time horizon; it is apparent that for such long-term forecasts, the results can provide no more than broad indications of trends and order of magniture of phenomena.

However, despite these limitations a long-term growth outline has been sketched in for the valley to broadly evaluate the level of development which can be attained when the envisaged projects are completed. An attempt has also been made to indicate the kind of relationship there will be between the Juba Valley and the rest of the country as a result of the impact of the huge projects envisaged.

In order to frame these forecasts, some basic points must first be made regarding Somalia's overall development aims, as indicated by the planning documents and other available information.

The assumed long-term planning aims to be pursued through the development of the Valley are:

a. To achieve full utilisation of the available labour force.

b. To ensure a better standard of living for the entire community, by proper redistribution of the increased wealth and income.

c. To ensure that the development projects will make the maximum contribution to net exports so that the development of the Juba does not result in Somalia becoming even more dependent on foreign aid, and, indeed, will help free the country from such bondage.

There is no basic conflict between these aims but they can only be simultaneously pursued if certain conditions are observed; these are explained further ahead. From the technical point of view it is probable that there will be an imbalance between population and resources. Thus, situations may arise in certain periods when not all the labour force will be fully employed. In certain cases where a choice must be made between leaving the excess labour force entirely outside the productive process, while guaranteeing an acceptable subsistence level, or of partial insertion in the process, the partial insertion solution has been selected. In other words, the development approach adopted will involve a certain amount of temporary under-employment in order to ensure a full employment model. The more rapid the rate of accumulation (compatible with the enforced intermediate stages of underemployment), the more quickly will the long-term goals be achieved. While on this subject, it should be mentioned that a possible fall in the rate of population in-

crease that is expected after the year 2000 will enable the final stage of full employment to be achieved at a greater rate.

2.2 DEVELOPMENT FORECASTS

In the following outline of forecasts, 2010 has been taken as the final reference year.

Similarly, the dollar is used as the reference currency in the forecasts. However, it must be made quite clear that the dollar values which appear in this outline are used purely as monetary expressions of the welfare index and have no deliberate significance either as an exchange of Somali shillings at current rates or as absolute monetary units. The use of dollars is dictated solely by the need to provide a concise monetary index of the prosperity of the community.

It has been assumed that the resident population in the administrative regions of the Juba valley will amount to around 2.8 million in the year 2010; allowing for some 200,000 nomads and another 400,000 who will actually be living outside the economic area of the Juba, there will be a total of 2.2 million gravitating around the Project Area in the year 2010. These are the people who must be considered in terms of income and employment.

The figures have been obtained by simple extrapolation of population data determined up to the year 2000 by more accurate estimates. However, the assumption of 2.8 million inhabitants in the Juba administrative regions seems reasonably reliable compared with the size of the population of Somalia as a whole, namely 40% of the expected 7 million total population. This percentage seems plausible, considering that at present the Juba regions have about 28% of the Somali total and allowing for the fact that the concentration of productive activity of the valley will certainly result in a large number of people moving into the Project Area.

Thus, accepting a Project Area population of 2.2 million inhabitants in 2010, we have attempted to assess the real possibilities of jobs for the labour force. The figures given in Table 2, have been derived by estimating how many jobs might be available in the various sectors which complement the agricultural and industrial development schemes and by applying coefficients relating the number of family members supported by each person in employment.

The following points may be made regarding Table 2:

a. The total number of employed amounts to a little less than one third of the total population.

b. The primary and secondary sectors provide a total of 435,000 jobs. The 215,000 jobs in the tertiary or services sector can thus be considered plausible, amounting to a little less than 50% of those employed in the directly productive sectors (especially since the figure also includes the armed forces, the police and the whole of the public administration).

c. The amount of employment in the agricultural sector as a whole amounts to some 57.7% of the total jobs available. This is not a high figure if considering the intensity of some activities in the agricultural sector (e.g. State Farms).

Table 2 - Forecast of number of employed and of population of the families of employed persons: 2010

(in thousands)

Sector	Number of Employed	Number of family members per employed person	Population of families of employed persons
Irrigated farming and rainfed farming gravitating around the districts	275	3.0	825
Livestock	50	2.5	125
Rainfed farming outside the districts	50	3.0	150
Fisheries, mining and industry	60	4.0	240
Tertiary sector	215	4.0	860
Total	650	3.4	2,200

Source: Technital development forecasts.

2.3 EMPLOYMENT CONSTRAINTS

To assess the reliability of the foregoing forecasts, employment data have been examined for each agricultural development scheme and each industrial project proposed for the Juba Valley Plan. The total number of jobs envisaged in the two sectors (i.e. the number of people who can certainly find employment according to the projects included in the programme) is below that of the preceding table. In other words, there is more labour available than there are jobs in the individual schemes and projects.

The following is the calculated employment situation on completion of the development programme:

Agriculture as a whole	190,000
Fisheries, mining and industry	60,000
Tertiary sector (estimated as 50% of the other two productive sectors)	125,000
Total employment	375,000

Applying the average weighed coefficient of 3.4 family members per employed person to the figure of 375,000 gives a total population of 1,275,000, which is far less than the forecast 2.2 million inhabitants. Even if the tertiary sector jobs amounted to 70% of the number provided by the productive sectors, the total would still only be of 425,000 employed persons, equivalent to a population of 1,445,000. So even accepting this very optimistic hypothesis, there is still a difference of around 750,000 people. Therefore something like another 220,000 additional jobs would have to be created in the Juba Valley in order to ensure full employment for a total population of 2.2 million.

This may mean that more labour will have to be absorbed in the schemes to be implemented, thus lowering the levels of productivity assumed for each. This raises the question of whether or not additional utilisation of labour may jeopardise the attainment of the production objectives, owing to the low levels of productivity in the schemes.

There are, in fact, two possibilities; the excess labour force can either be absorbed in the schemes or it can be decided to maintain the envisaged technical productivity levels of the schemes, while guaranteeing the standard of living of the excess population through an appropriate process of wealth redistribution. In both cases it will be necessary to respect the planned overall production targets.

2.4 GROWTH OF INCOME

Implementation of the Juba Valley Development Plan should boost income not only in the Project Area, but throughout the rest of the country too, by induced effect and the redistribution of wealth. Dollars have been used to evaluate the order of magnitude of possible income in 2010. The reasons for so doing and the significance of using this unit of currency solely to

express the physical growth of prosperity in a country with a centralized economy, have already been explained.

By reference to the suggested development programme, an estimate has been made of the overall growth of income of the Juba valley when all the proposed schemes are completely operational. Reference has also been made to certain trends and to development experience in other economies in a phase of rapid expansion.

An approximate estimate has also been made of the country's national income in 2010 utilising average annual growth rates which appear acceptable. The next step was to derive the percapita income. The figures are indicated in the Table 3. Because of the virtual lack of basic data for 1975, and also of long-term planning indicators (ten or twenty year) it is apparent that the data in the Table indicate no more than possible future trends, being based essentially on average annual growth rates considered reasonable for countries such as Somalia. But it should be noted, too, that these assumptions are also supported by the data on production quantities and values expected from the implementation of the valley development programme.

Table 3 - Income growth assumptions: 1975 - 2010

Year	Juba Valley	Rest of Somalia	Somalia
		Total income (US $ million)	
1975	64	176	240
2010	770	1,080	1,850
Average annual growth rate	7.3	5.2	6.0
		Per-capita income (US $)	
1975 (1)	80	80	80
2010	350	225	265
Average annual growth rate	4.3	3.0	4.0

Source: Technital estimates

(1) As these are preliminary estimates, for convenience, the per-capita income has been considered to be the same for the whole of Somalia in 1975, though more accurate estimates appear to indicate a lower figure for the Juba Valley.

With the agricultural development schemes at cruising speed, production levels should be:

Product	Production levels in 2010 (thousand tons)
Cereals	700
Oil seeds	103
Vegetables	277
Grain pulses	63
Sugar	200
Cotton	22
Minor textiles	17
Tobacco	12
Bananas	512
Fruits	33
Meat (*)	35

(*) Equivalent standard carcass weight.

Considering all the envisaged developments, the value of gross production of the agricultural sector in the valley in 2010 should be around So.Sh. 2,100 million. As already stated, the production aims for the valley take due consideration of the constraints which may affect the export of agricultural and livestock products.

2.5 POTENTIAL FOREIGN DEMAND

It is extremely difficult to make very long-term estimates of the specific limits of various markets for individual products. Therefore a broad estimate of the export ceilings of products from the Juba Valley has had to be made. This is just one of the uncertainties which beset forecasts of the Development Project.

It is apparent that as there are no fundamental statistical data for making correct econometric projections, forecasts have had to be based mainly on assessment of preferential trends of potential markets. In this way it has been possible to establish some market shares that are in line with the overall development picture of the importing countries and may thus be considered as objective assumptions for future Somali foreign trade.

An analysis has been made of Somali trade by areas of origin and destination of the goods and bearing in mind recent trade agreements. As a result, the potential export areas have been identified as the Arab countries, and EEC countries, especially Italy, plus some other countries such as Iran.

Taking account of the general economic policy choices of the country and the constraints of various natures on levels of production, the most significant Juba Valley export products are rice, bananas, grapefruits, oil-

seeds, sugar, tobacco and meat.

The export targets by area of destination can be summarized thus:

Product	Area of destination	Quantity exportable after 1990 (tonnes)
Rice	Arab market	100,000
Bananas	Arab market + Iran + European market	560,000
Grapefruit	European market	45,000
Sugar	Arab market	100,000
Oil seeds	Arab market	40,000
Tobacco	Arab market	10,000
Meat (*)	Arab market	60,000

(*) Equivalent standard carcass weight.

The method of forecasting quantities is explained in detail in Vol. II, Part II. It involves the complex processing of FAO estimates, appropriately corrected, for domestic production, domestic demand and imports of countries which could become involved in Somali foreign trade.

In the case of the large import potential of the Arab oil exporting countries and of the industrial nations of Europe, the portion of Somali production that can be exported has been evaluated taking account of the relative levels of internal and inter-regional prices, transport costs, potential of competitive countries and quality of the goods concerned.

When forecasting Somali foreign trade trends, due consideration has been given to the effect of modifications in the structure of world foreign trade, following the recent changes in the oil sector, which have opened up the Arab markets and also boosted the propensity of the Arab people to consume more and import more. In the case of Italy in particular and the EEC in general, the reopening of the Suez Canal and particularly the Lomé Agreement would indicate that European markets will be wider open to African products, especially those from Somalia. For instance, Protocol No. 6 of the Lomé Agreement favours the import of bananas by Community countries. It must also be emphasized that, in perspective, the international trade situation will tend to favour the Arab markets, as importing countries, since unlike European markets they will enable a wider range of Somali products to be exported.

When forecasting, a time horizon has been fixed as "after 1990" for the sake of convenience. This has been done to indicate mainly the broad lines of the structure of the potential import market which can only take shape in the long-term and certainly during a period which lies beyond 1990.

2.6 BALANCE BETWEEN PRODUCTION, DOMESTIC DEMAND AND FOREIGN DEMAND

When the project is completed, in 2010, by which time most of the irrigation schemes should be in operation, production from the Juba Valley should satisfy the bulk of the domestic demand for the major agricultural products and should also help boost exports considerably.

The following assumptions have been made regarding domestic demand:

a. Per-capita consumption and the demand structure in 2010 will remain the same as carefully estimated for the year 2000.

b. Growth in domestic demand after 2000 will follow the same trend as that of population increase.

These forecasts are justified to the extent that, considering the envisaged production level, it is not intended to greatly modify the prospects opened by foreign demand.

Table 4 - Contribution of Juba Valley to satisfying domestic and foreign demand for agricultural products when the project is completed: conventional year 2010 (thousand tons)

Product	Domestic demand	Potential foreign demand	Juba Valley production
Cereals	1,085	100.0	700.8
of which: rice	158	100.0	250.0
Fruit	200	602.0	582.0
of which: bananas	108	557.0	512.0
grapefruit	5	45.0	30.0
Sugar	215	100.0	200.0
Vegetable oils	45	40.0	35.5
Cotton	70	-	22.2
Tobacco	3.8	9.5	12.1
Meat (*)	145	60	35

Source: Technital data processing

(*) Equivalent standard carcass weight.

Where foreign demand is concerned, we have considered the estimated data on growth in demand for Somali products "after 1990".

Juba Valley production will cover the whole of the domestic demand for rice, fruit and tobacco, as well as most of the country's demand for sugar (93%) and for vegetable oils too (79%).

Valley production will help cover about two thirds of the country's domestic demand for cereals (1).

For individual products or classes of products, the contribution which the Juba Valley can make towards satisfying foreign as well as domestic demand is indicated in Table 4.

Coverage of export demand will vary from 100% in the case of meat, to 92% in the case of exportable rice and 55% where grapefruit is concerned. Other products lie between these extremes.

The levels of coverage in domestic and foreign demand provided by Valley products must also be seen in relation to the growth in production which will occur in other parts of the country.

2.7 PRELIMINARY ESTIMATE OF TOTAL INVESTMENT

The Juba Valley Development Plan will involve an estimated overall investment of some So.Sh. 36,000 million over a 35-year period, i.e. the time it is presumed will be required to bring all the development projects in the agricultural and livestock sector to a standard level of production. The period for industries and other supporting sectors is more or less the same.

Table 5 gives a sectoral breakdown of the investment. It should be noted that the ensemble of directly productive schemes will cost some So.Sh. 11,700 million excluding investments in housing infrastructure and supporting sectors.

There is a So.Sh. 4,900 million investment in irrigation schemes i.e. a little more than 40% of the total, while investments in the livestock and industrial sectors account for approximately one-fifth and those in hydraulic works alone to a little more than 6%. As these are preliminary estimates it is felt that for convenience an expenditure of 10% of that envisaged for the directly productive sectors can be assigned to cover schemes in the supporting services (tertiary) sector directly bound up with the development of the Valley.

Separate estimates are made of the additional cost for civil infrastructure and structures, designed to raise the living standards of the po-

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(1) As regards cotton - on the basis of 1 kg per capita - a cautious estimate would indicate that domestic demand will be running at around 70,000 tons in the year 2010. Production from the Juba Valley could cover only 30% of this, so it must be expected that Somalia will continue to be a net importer of cotton. This situation is attributable to the soil and climatic constraints which condition growing of cotton in the Valley.

pulation. These investments can be made in relation to the residual financial resources available, once the funds required for the directly productive schemes have been allocated.

If the total investment of about So.Sh. 11,700 million were divided equally over all the years of the planning period, it would give an average annual investment in productive structures of around So.Sh. 335 million. This figure seems to be in line with the financial committment the government is disposed to undertake, in the light of the priorities already assigned to the Juba Valley.

Table 5 - Investment programme for the Juba Valley up to 2010 (million So. Shillings)

Sector	Description of scheme	Costs	Percent of total
1. Hydraulic works	Saakow and Baardheere dams, irrigation canals, various barrages on rivers	750	6.4
2. Physical infrastructure	Roads, power generation and distribution, water supply networks	1,500	12.8
3. Irrigation development schemes	Costs of reclamation, investment in agricultural machinery, pumping stations, irrigation and drainage, infrastructures and stores	4,900	42.0
4. Livestock	Rangeland improvement, setting up of waterpoints for cattle, veterinary service, equipment and materials	500	4.3
5. Industrial development	Since the planning of the industrial sector scheme covers a maximum period of 20 years, the estimates of the whole period have been proportioned to the investments envisaged in the primary sector	2,000	17.1
6. Other sectors of activity including the tertiary sector services	10% of items 1 to 5	965	8.3
7. Contingencies	10% of items 1 to 6	1,060	9.1
Total		11,675	100.0

Source: Technital data

The cost of civil infrastructure and structures (houses, schools, hospital and social services) should be added to the foregoing. An estimated per-capita cost of So.Sh. 11,000 gives a total of So.Sh. 24,200 million for this item.

CHAPTER 3.

Note:

After the presentation of the study the Somali Government has given indications about changes in the proposed cropping patterns to account for decisions taken when the study was on the way of completion.
Anyway it has not been deemed opportune to change the whole analysis here performed as the proposed cropping patterns deserve their indicative value. The whole set of changes has been accounted for in the short- and medium-term development plan.

PROPOSED PROJECTS FOR THE VARIOUS SECTORS

3.1 HYDRAULIC WORKS

This part leads to a preliminary definition of the hydraulic works necessary to solve the two basic problems for development of the Valley: flood control and flow regulation.

The approach has been to consider firstly the two problems separately and then to combine their requirements.

3.1.1 The Flood Problem

The main problem which must be solved before the Juba Valley can be properly developed is how to protect the land from flood waters which spill out of the river channels and from rainwaters which pond in the lower reaches and cause frequent, vast swamps owing to the low permeability of the soil.

Every five years, on average, the Juba tends to break its banks and destroy crops thus profoundly altering the productive activities in the Valley. Flooding virtually prevents full use being made of the resources, especially in areas which have a high development potential.

The investigations, described in detail in Vol. III, show quite clearly that agriculture in the Juba Valley is conditioned to a very large extent by the flood phenomena. In some cases, floodwaters are put to beneficial use especially in the "descecks", over 120 of which occur along the course of the river down to Anole covering something more than 30,000 ha; in others they are damaging especially when they invade rational modern farming schemes.

At the present time the river channel is capable of handling around 700 m^3/s which could be contained completely by a few not very costly longitudinal works. However, there is a 50% probability that discharges will exceed this amount. This danger must be eliminated. Even though flows in the region of 800-900 m^3/s may not cause serious damage, they occur with a probability of 40%. When instead the discharge exceeds 1,200 m^3/s, which occurs with a probability of 20%, then the floods are disastrous.

During the short period of systematic observation of the river (14 years), the maximum discharges recorded at Luuq were in the order of 1,600 m^3/s and occurred with a probability of 5%. The maximum 100-year flood is estimated to be around 2,000 m^3/s.

At Baardheere as well as at Kaitoi the 1% and 5% probability floods are characterized respectively by peak flows of 1,800 m^3/s and 2,400 m^3/s.

Lacking an adequate historical record of flows, the study has considered the models of the hydrographs plotted for the Baardheere section in the Selchozpromexport report in relation to the above floods which occurred at the Luuq section once in the autumn of 1959 and again in the autumn of 1961. Reconstruction of the hydrographs has involved correlation of events at the two stream gauging stations and the probability of flood occurrence, considering the 100 and 20-year values in particular.

In this study, the values for both probabilities are examined as first and second critical cases so as to optimize the choice of flood control projects. It should be noted here that the volumes of streamflow during the 1959 and 1961 floods were roughly equivalent, though the trends of the floodwave were slightly different.

In calculating flood volume and flood storage, account has been taken of the bicuspid nature of the hydrograph, and it has been assumed that it will be possible to take advantage of the concave part of hydrograph.

The storage values W necessary for flood protection have then been calculated assuming different spillway discharges, Q_{sf}, and different discharges which have to be diverted downstream from the river channel, here termed Q_{sc}, since they exceed the natural capacity thereof (700 m^3/s).

	Probability 1%	Probability 5%	
Q_{sf} = 600 m^3/s	W = 3,000 x $10^6 m^3$	W = 1,700	Q_{sc} = 0 m^3/s
= 700	W = 2,400	W = 1,250	= 0
= 800	W = 1,800	W = 1,100	= 100
= 900	W = 1,550	W = 850	= 200
= 1,000	W = 1,300	W = 600	= 300
= 1,100	W = 1,100	W = 450	= 400
= 1,200	W = 900	W = 350	= 500

3.1.2 The Flow Regulation Problems

The first use of the water resources taken into consideration is irrigation. Two phases of development of the Valley have been considered to define the water regulation requirements for irrigation.

The first one leads to the necessity to guarantee a minimum flow of 27 m^3/s in the driest months, i.e. water requirement for irrigation of 34,000 ha of pluriannual crops, foreseen by the 10th year of project life, meanwhile in the second phase a total annual water demand of 3,277 million m^3 has been calculated, i.e. water requirement at full development, the required flow varying throughout the year according to monthly water needs of various crops.

Table 6 shows the monthly water demand which has been calculated for the five basic alternatives of cropping patterns which have been selected.

Even if there were further expansion and if it is assumed that the irrigation area is eventually increased by about 30,000 ha (some 15% of the previous total) it is not felt that consumption will change greatly. The reasons for this are:

a. It is reasonable to think that as time goes by the farmers will become more familiar with irrigation practices and increasingly more advanced techniques will be introduced, both as regards the construction of supply networks and on-farm equipment. These will result in considerable economies in water-use which, by comparison with what is achieved in more developed countries, could amount to around 20% in all.

b. The crops introduced during the third period are less demanding, as regards water. Taken together with the irrigation improvements this should mean that consumption will be around 8,000 m^3/ha.

Table 6 - Irrigation requirements (at head end of district) - in $m^3 \times 10^6$

	A	M	J	J	A	S	O	N	D	J	F	M	Total	
I Phase (ha 34,000)	55	53	59	67	55	51	69	78	84	83	66	59	779	
II Phase														
Alternative A	86	219	344	390	197	183	352	354	304	130	95	105	2,658	Without forage in Districts 2 and 5
Alternative B	107	233	355	315	243	222	363	363	390	184	146	162	3,024	Without forage in District 2
Alternative C	112	242	364	323	252	231	367	364	333	192	156	172	3,108	With forage in Districts 2 and 5
Alternative D	142	277	379	316	280	253	401	388	331	179	144	182	3,277	With forage in Districts 2 and 5, and rice in District 6
Alternative E	122	265	380	302	241	218	399	390	316	130	95	128	2,990	Without forage in Districts 2 and 5, but with rice in District 6

c. The monthly demand diagram for these crops comes to be closer to the diagram of natural flows.

During the final engineering stage this situation will have to be examined in greater detail and the relevant data possibly introduced into the calculations of flow regulation volumes and those concerning dimensional design.

A second use of the Juba flows is to provide together with water wells domestic supplies for settlements in the Juba valley and Kismayo. Though the volumes involved are relatively much smaller than those required for irrigation, they are equally essential for the development of the region. There should be several modern water supply services. The first system would be for Luuq and Dolow down to the Merilé area; the second would be for Baardheere and the areas downstream as far as Faanoole, and the third for the Jilib area and downstream as far as Kismayo. Each of these three water supply systems would be complete with its own treatment plant.

Another use for the Juba waters - coordinated with the two outlined above - could be for the generation of electricity. The heads available for producing power are dealt with further on. The power generated could be used to pump up water for the irrigation and domestic water installations, while also providing a small amount for local consumption.

Beyond all this it has been considered that a minimum flow on the river bed must be maintained for sanitary purposes.

The total monthly water requirement which have been calculated at full development of the valley is reported in Table 6bis.

Two critical cases have been considered for calculation of regulation storage required:

- in the first phase they are based respectively on the sequences of months with minimum streamflow over the period of record of observation of flows (14 years) and with flows immediately above, which have probability to occur of about 1% and 12%;
- in the second phase it has been considered the capacity required to cover completely water requirement in 100% of the years and in 93%, this second case being the maximum reliability obtainable providing only for annual regulation. This hypothesis could become compulsory if the salinity of the flood waters would result to be prohibitive for a pluriannual regulation, thus making necessary the complete drying of the reservoir every year. The regulation storage requirements, accounting also for infiltration losses in the canals, for water supply for human consumption and for sanitary considerations (see also Para 4.2, Part II), are as follows:

in million m^3

	1st phase	2nd phase
1st critical case	250	1,518
2nd critical case	160	1,140

Table 6bis - Total monthly and annual water requirements (10^6 m^3)

Solution	J	F	M	A	M	J	J	A	S	O	N	D	Year
A	183.4	141.1	155.4	133.7	280.9	417.1	359.3	257.0	239.8	427.3	428.0	374.4	3,397.4
B	242.1	197.1	218.3	156.9	297.1	430.0	387.1	307.8	283.2	439.2	438.3	402.5	3,799.6
C	252.0	207.5	229.8	161.7	306.6	439.3	395.4	317.4	292.8	443.9	439.5	406.5	3,892.4
D	237.5	195.1	241.0	195.6	345.2	455.6	388.4	351.8	317.0	481.1	466.2	404.3	4,078.8
E	183.4	141.1	180.7	173.8	334.8	456.7	372.5	305.4	278.3	478.9	467.9	388.4	3,761.9

3.1.3 Integrated System of Flood Control and Flow Regulation

Discussion of possible alternatives

It is technically feasible to provide protection against the Juba floods either by building embankments or flood-topping facilities. If embankments were built right along the river, they could lead to the destruction of the forest gallery which constitutes a basic feature for bank conservation. If the embankments were set some distance away from the river, the most fertile land would be lost, as would several human settlements, albeit small ones. Cost estimates of these schemes indicate that the order of magnitude would be So.Sh. 95 million and So.Sh. 50 million, respectively.

Another system of flood control involves the creation of one or more reservoirs either in or near the river channel. The volume required for such a system of control, are those defined above. They have been considered together with those needed to provide annual or multiannual flow regulation, so as to unify the two basic functions in the resulting structures. In the various Phase II water-use hypotheses, it has been found there will be useful volumes of between 3,000 and 4,000 million m^3.

It is also been sought if there is for Phase I flow regulation requirement. This solution allows for the lower volume requested and for the urgency with which the project should be implemented.

Considering the dimensions involved, stemming from the variables in play, an examination has been made of the storage possibilities on the Juba. This is summarized case by case upstream from the coast.

It has been ascertained that no reservoirs can be sited below Manane because of the amount of good agricultural land which would be submerged and lost.

The first idea explored was that of a spreading basin between Dujuuma and Faanoole. The water would be held back by means of a fixed or semi-fixed weir in the channel. A preliminary assessment of stability and watertightness indicates these to be satisfactory at the weir and in the reservoir basin. The desired storage capacity could be obtained by building a dyke across the valley from the weir. The dyke would swing upstream to a point where the elevation of the crest of the dyke is the same as that of the land. The cross-slope of the valley is virtually negligible, while the longitudinal slope is around 0.25%. With a dyke rising to a maximum height of 10 m, which would not be particularly costly or difficult to build - the total length would be 80 km (of which 20 km across). Allowing a freeboard of 2 m on the sill of the weir, the pool area necessary for a storage volume of 1.5 x $10^9 m^3$ (1) would be around 550 km^2. With evaporation estimated at around 2 m per year there would be a loss of over 1,000,000,000 m^3 or 30% of the eight years in ten streamflow, for which the water-use projects are designed. With such losses this solution is obviously not acceptable. A variation of the same idea, using a higher dyke, is not viable because of the length of the dyke and the cost of the structure itself. By way of example, with a dyke 20 m high and a pool area of 250 km^2, evaporation losses would be 500 x $10^6 m^3$ per year. The stor-

(1) About 400 x $10^6 m^3$ reserved for siltation over a 50-year period.

age basin would be over 120 km long and the approximate cost would exceed So.Sh. 1,000 million. Thus this solution has also had to be discarded.

A decidedly more favourable situation is encountered to the north of Dujuuma, where the plain starts to narrow, forming a valley in the strict sense of the word below Saakow. Detailed studies have been performed here. These are described ahead (see Para 3.2).

In the reach to the north of Anole up to Baardheere, where the river cuts through the hills, one of the restraints is the elevation of the town of Baardheere and the gardens here, which would mean that the dam could be no more than a score or so metres in height. Under such conditions the required storage volume could not be attained. Even at some distance from the river the landform of the plain does not offer any reasonable solutions. The depression to the southwest of Baardheere may offer some limited possibilities, though insufficient data are available and a check would have to be made of elevations both of the area itself and of the surrounding high ground.

Going upstream towards the mountainous stretch north of Baardheere, the valley is still broad in the first few kilometres.

Then geomorphological conditions are encountered which are certainly favourable for the construction of a dam providing a reservoir of the order of size required. Reference should be made to the sectoral report for more detailed information on this stretch of the river, which runs for some 150 km north of Baardheere.

Between Marile and Dolow there is a broad valley with an even lie and a very tabular structure where conditions are similar to those in the areas to the south of Anole. Hence it would be difficult to build a proper flood control facility.

A possibility, albeit marginal, of topping the floods may exist on the Dawa Parma whose waters could be diverted by a long, costly canal to the nearby depression of Ceel Macaw. There are no data available to assess the flood contribution which this tributary makes to the Juba. However the catchment covers about a quarter of the whole of the basin upstream of Luuq. Yet it must be borne in mind that the proposed flood control structure would be very isolated and part of it would lie in Ethiopian territory. It would be costly, as mentioned, and so it is not recommended that there be any further examination of this possibility. In anycase a suitable hydrological and topographic basis would be required and this certainly could not be provided within a reasonably short space of time.

Recommended solutions

From the investigations described above it emerges that two barrages and reservoirs are feasible upstream of Saakow and upstream of Baardheere. To provide for flood control by construction of embankment or of floodway canals discharging in a reservoir at some distance from the river or in areas not draining to the river, should be discarded.

Preliminary evaluations (1) indicate that increasing the height of

(1) Based on uncontrolled contour maps in scale 1:20,000, with 10 m interval for contours, obtained by plotting the 1:60,000 RAF air photos.

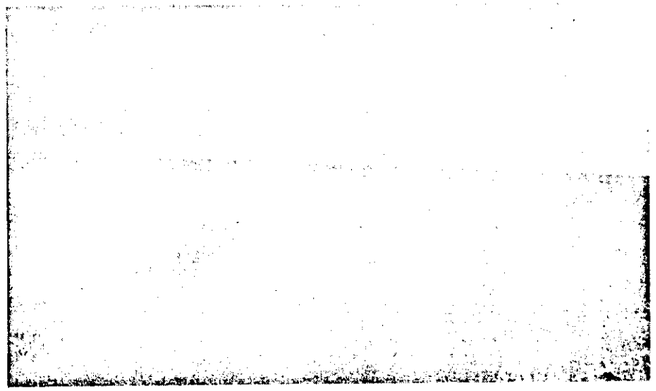


Photo 1 — Baardheere Reservoir — Southernmost part of the Juba Valley where the river runs between limestone terraces, seen from the south.
Foto 1 — Bacino di Baardheere — La parte più meridionale della Valle del F. Giuba che corre nei terrazzi calcarei, vista da sud.

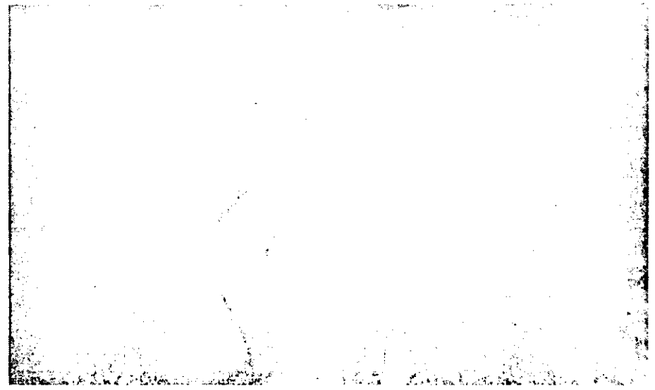


Photo 2 — Baardheere Reservoir — Juba Valley at Technital Section 1 (area in shade), seen from the south.
Foto 2 — Bacino di Baardheere — La Valle del F. Giuba all'altezza della sezione Technital 1 (zona in ombra) e della sezione russa (zona dell'ansa), vista da sud.

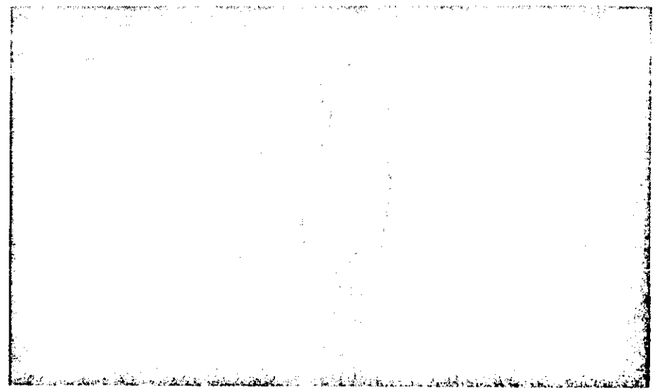


Photo 3 — Baardheere Reservoir — Juba Valley at Technital Section 2, seen from the south.
Foto 3 — Bacino di Baardheere — La valle del F. Giuba all'altezza della sezione Technital 2, vista da sud.

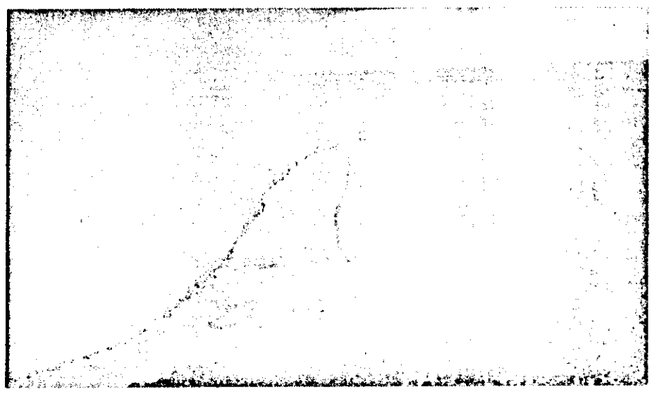


Photo 4 — Baardheere Reservoir — Juba Valley at Technital Section 6, seen from the south.
Foto 4 — Bacino di Baardheere — La Valle del F. Giuba all'altezza della sezione Technital 6, vista da sud.

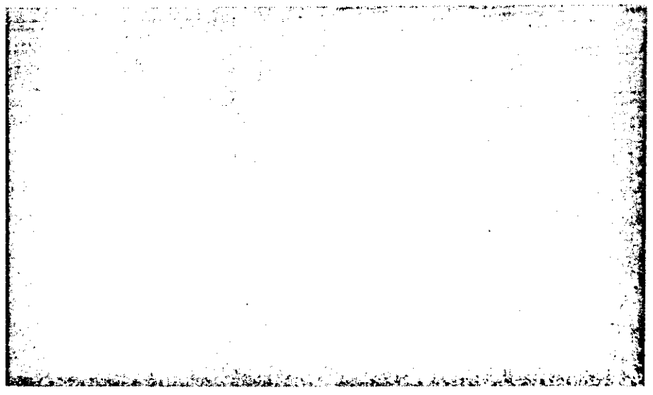


Photo 5 — Baardheere Reservoir — Juba Valley at Technital Section 8, showing part of reservoir area, seen from the south.
Foto 5 — Bacino di Baardheere — La Valle del F. Giuba all'altezza della sezione Technital 8 con visione parziale del bacino di invaso, vista da sud.

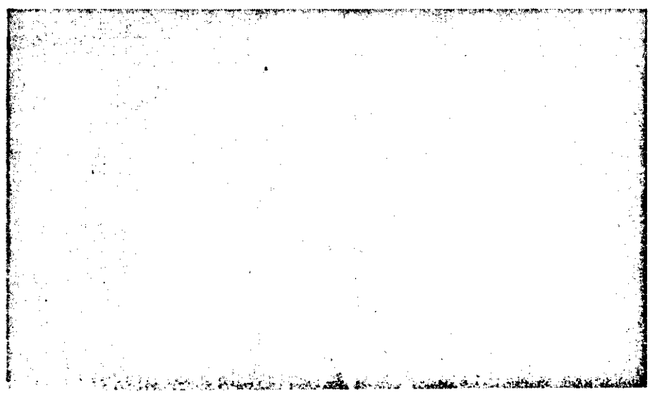
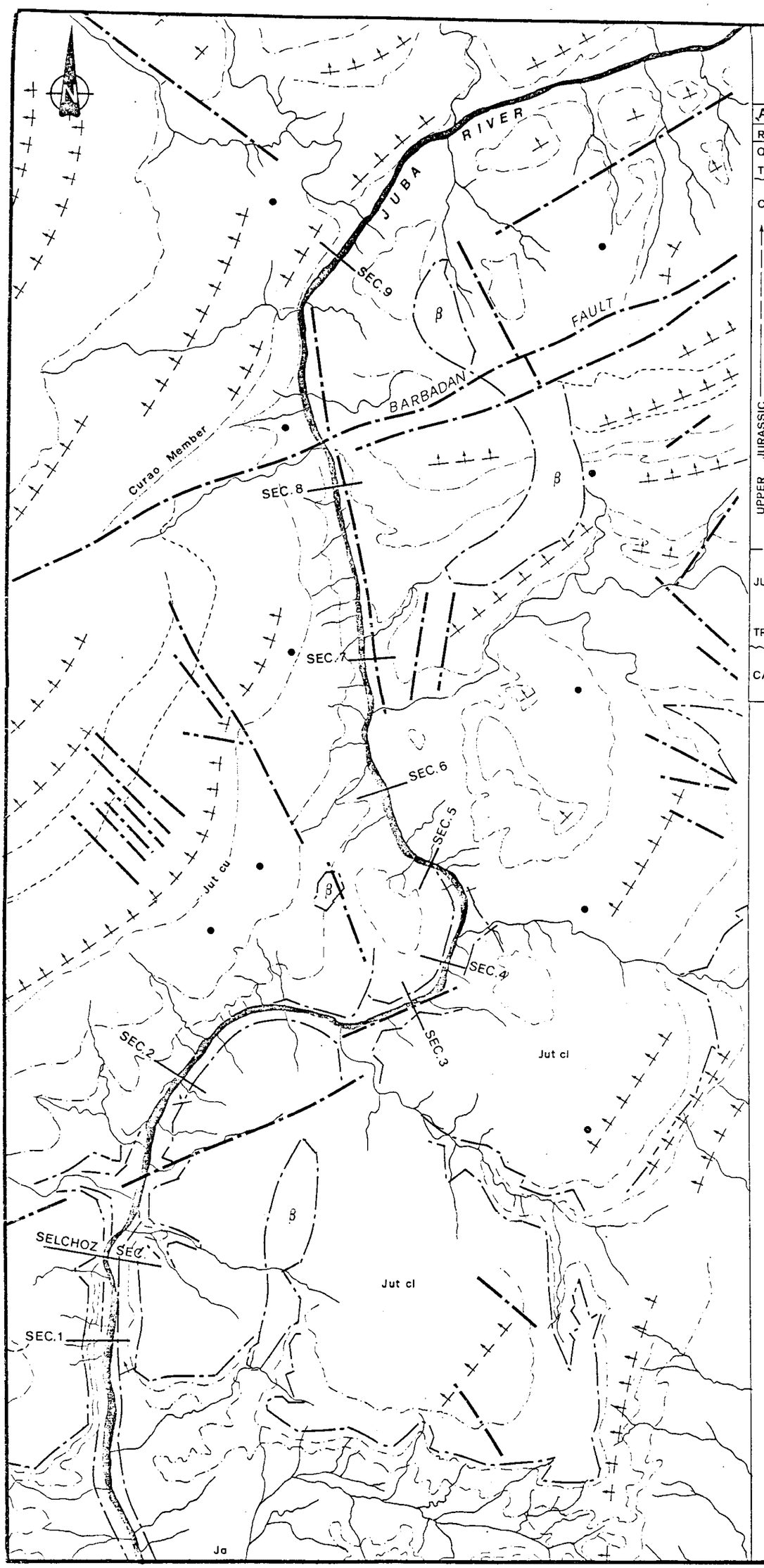


Photo 6 — Baardheere Reservoir — Juba Valley at Technital Section 8, seen from the north.
Foto 6 — Bacino di Baardheere — La Valle del F. Giuba all'altezza della sezione Technital 8, vista da nord.



STRATIGRAPHIC COLUMN
EL WAK BASIN & REGION WEST OF BUR UPLIFT

AGE		FM	
RECENT			alluvium al, el — caliche cl
QUATERNARY			QT — basalt flows β
TERTIARY			
LOWER CRETACEOUS		Garba harre	Mao member ss,dolo ls, dolo,sh,gyp Jkgh m — ss, silts, sh, maris, tuffs & top
			Busul member ss, ls, sh Jkgh b — Ambar formation sandstone
UPPER JURASSIC — Purbeckian		Uegit	Mererta member Jut mr; Muddile member ss Jut mu — Jk ab
Portlandian			Curao member Jut cu
			Colalio member Jut cl — Uellea formation ls Jue
Kimeridgian		Anole	Anole fm sh, maris, ls Ja
Oxfordian		Iscia Baidoa	Goloda member ls — also Jg1 & Jg2 — Jib g
Callovian			Baidoa member ls — also Jb — Jib b
			Deleb member ss — also Jdb — Jib d — Uanei member sh Jib u
LOWER JURASSIC		Mansa Guda	Mansa Guda transgressive conglomerates, sandstones thickness variable
TRIASSIC (?)			
PRE-CAMBRIAN			Basement complex bs

Photogeologic dip (1°–3°)
Giacitura fotogeologica degli strati

Fault
Faglia

Unit boundary
Limite delle unità litologiche

Photogeol. &/or morphologic mkr.
Limite formazionale individuato foto-geologicamente e/o morfologicamente

Drainage
Drenaggio

Water well
Pozzo

Bedding trace
Traccia di stratificazione

0 1 2 3 4 5Km

Source : HAMMAR PETROLEUM CO. — SOMALI PROJECT
MERCATOR SERIES I — PHOTOGEOLOGIC SHEETS B2-3 & C2-3

TECHNITAL SpA

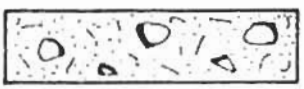
fig. 3

BAARDHEERE AREA : PHOTOGEOLOGIC MAP

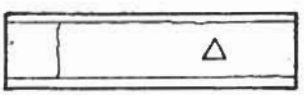
ZONA DI BAARDHEERE : CARTA FOTOGEOLOGICA

LEGEND Fig. 4a,b. *LEGENDA*

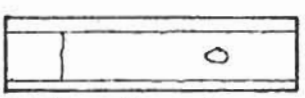
Alluvial sand with clayey lenses
Sabbie alluvionali con lenti argillose



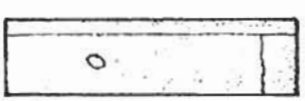
Fallen block debris
Detriti di falda



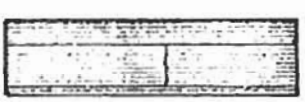
Calcarenite
Calcarenite



Oolitic calcarenite
Calcarenite oolitica

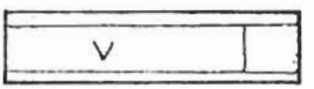


Oolitic limestone
Calcare oolitico

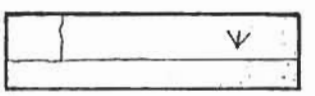


Bituminous limestone
Calcare bituminoso

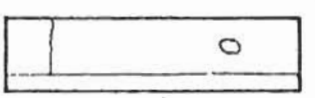
Marly limestone
Calcare marnoso



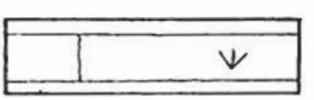
Fossiliferous limestone
Calcare fossilifero



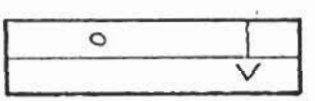
Coral limestone
Calcare corallino



Pisolitic limestone
Calcare pisolitico



Coral & pisolitic limestones
Calcari corallini e pisolitici

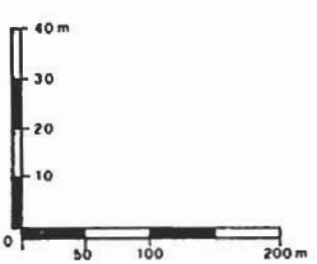


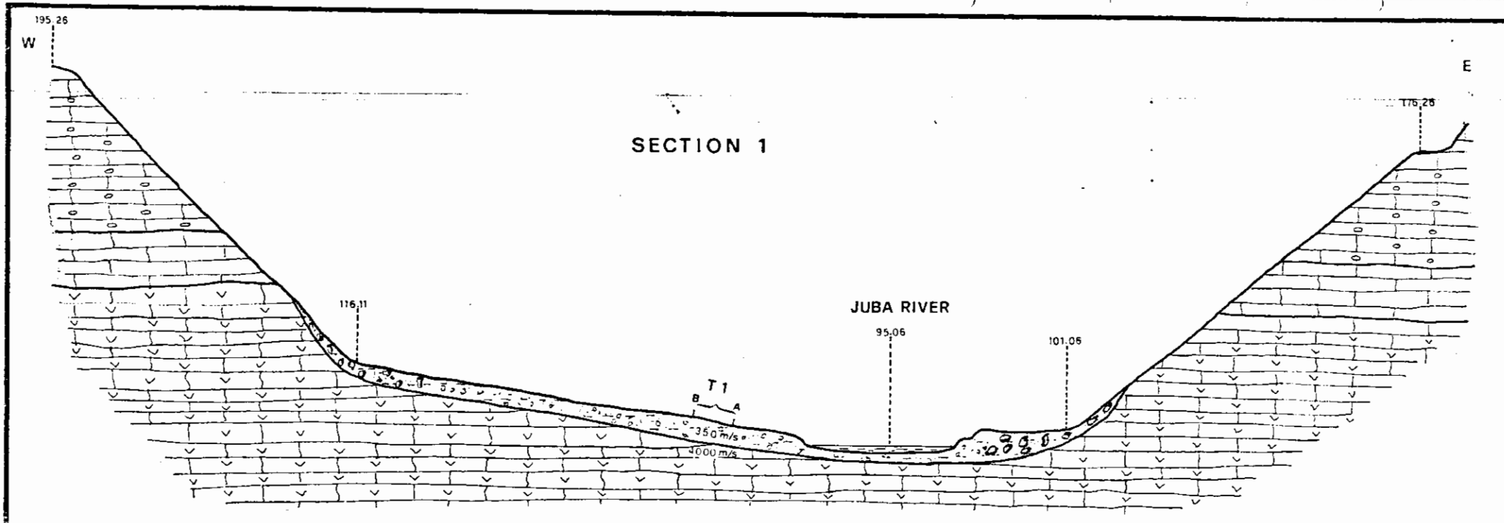
Pisolitic & fossiliferous limestones
Calcari pisolitici e fossiliferi

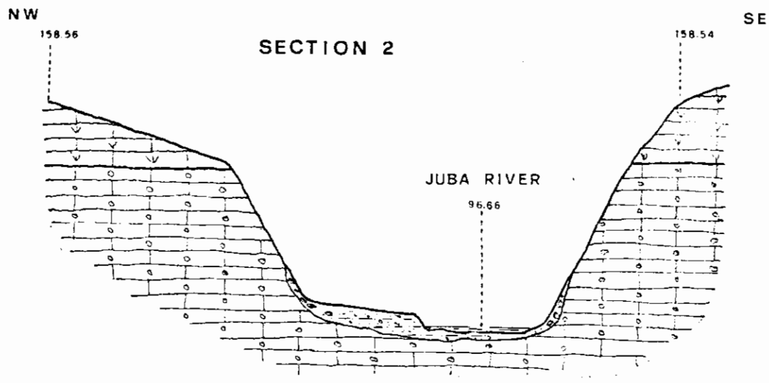
T1 Seismic traverse
Traversa sismica

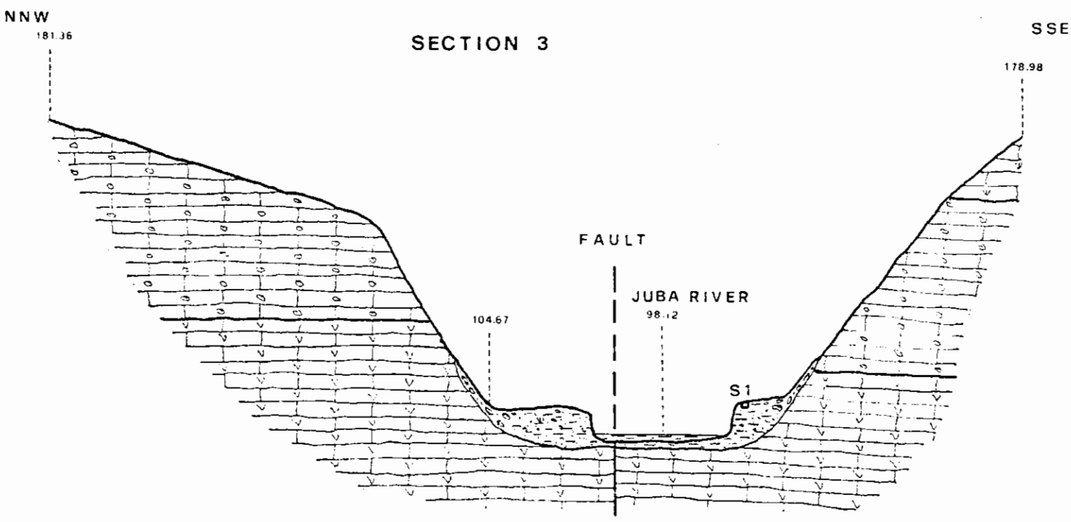
4,000 m/s Velocity of compressional waves
Velocità delle onde di compressione

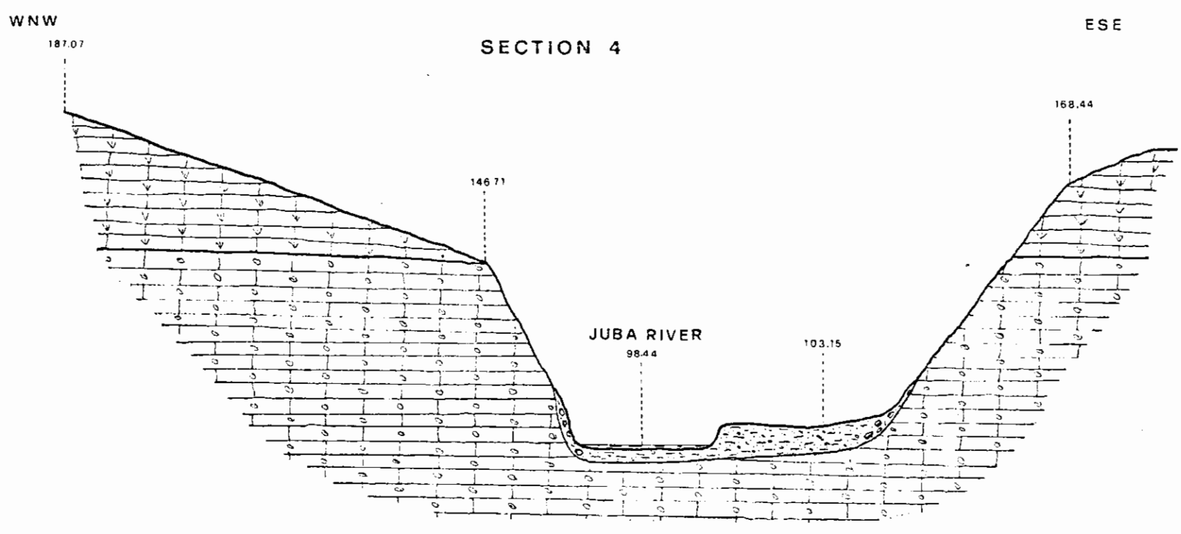
S1 Soil sample
Campione di terreno









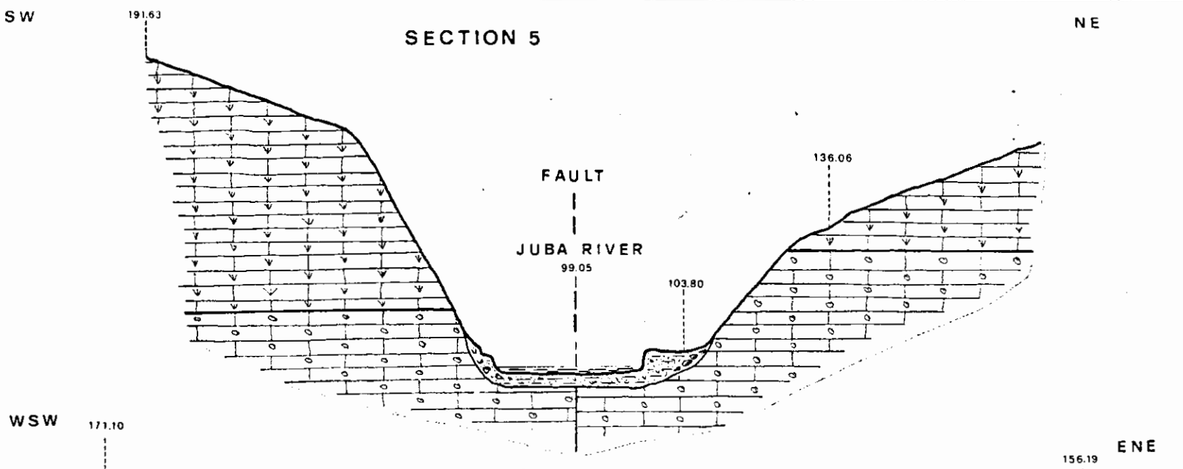


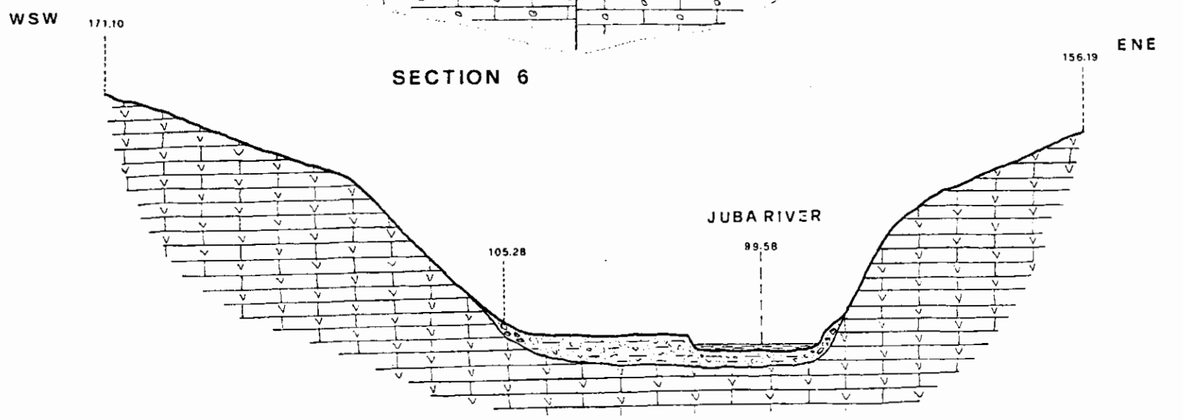
TECHNITAL SpA

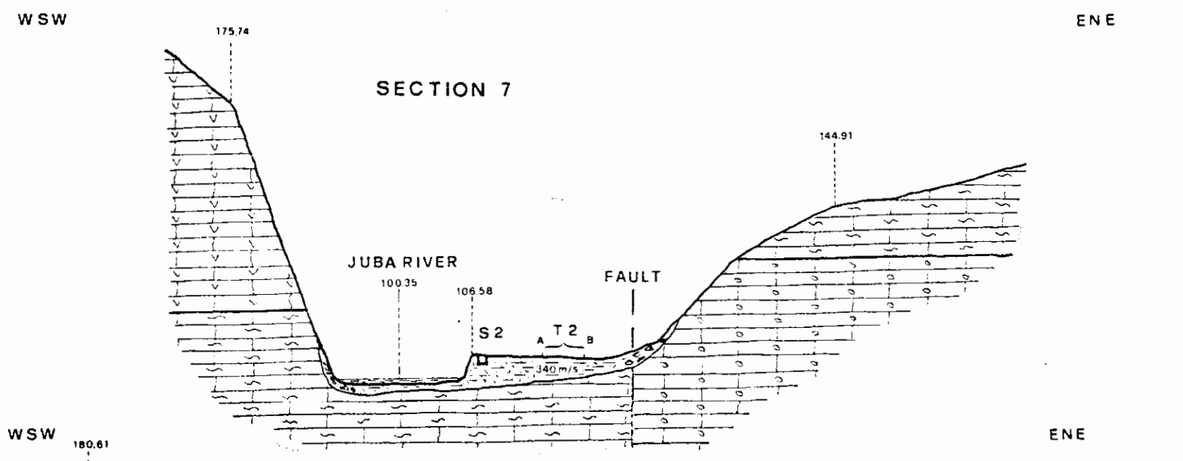
fig. 4a

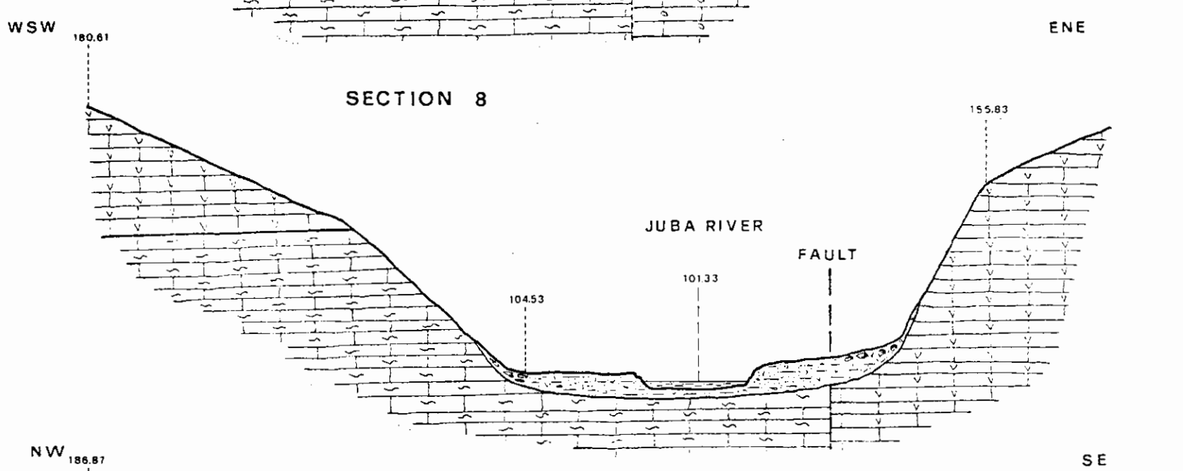
BAARDHEERE : GEOLOGICAL SECTIONS

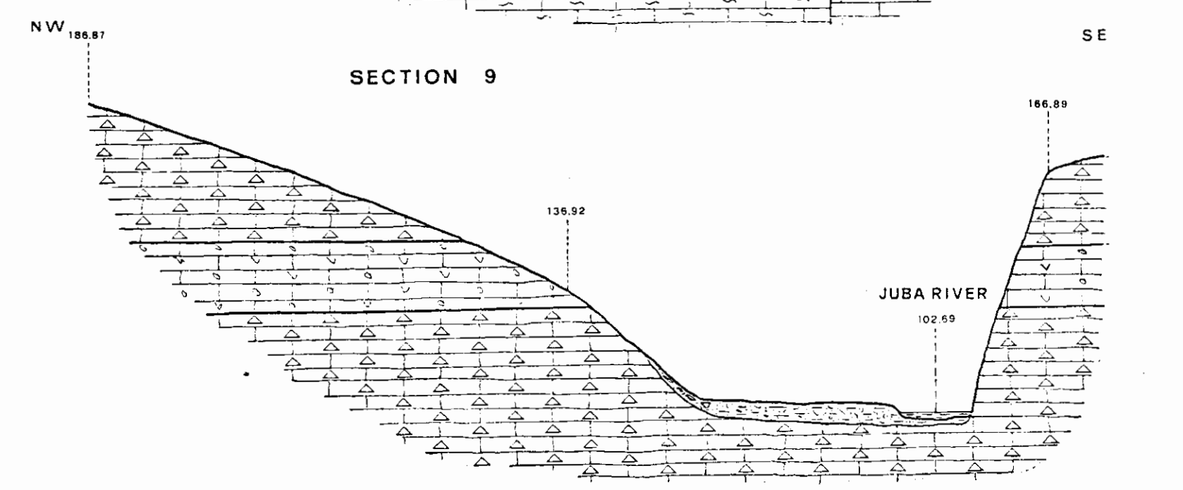
BAARDHEERE : SEZIONI GEOLOGICHE











TECHNITAL SpA

fig. 4b

BAARDHEERE : GEOLOGICAL SECTIONS

BAARDHEERE : SEZIONI GEOLOGICHE

when further information on the nature of the ground and the consistency of the underlying rock formations will be available.

Data on the pool area and the storage volume if the dam site were along Section 3 are as follows:

Elevation	Area	Volume
Up to contour 104	37 km^2	146,000,000 m^3
Up to contour 106	50 "	232,000,000 "
Up to contour 108	63 "	345,000,000 "
Up to contour 110	78 "	486,000,000 "
Up to contour 112	97 "	661,000,000 "

If instead the dam site were at Section 8, where it would certainly have to be situated should a higher dyke be built, the values concerned are as follows:

Elevation	Area	Volume
Up to contour 112	72 km^2	431,000,000 m^3
Up to contour 116	110 "	613,000,000 "
Up to contour 120	148 "	871,000,000 "

3.3 IRRIGATION DISTRICTS

3.3.1 Productive Guidelines

Considering the general directives for development of this sector and forecasts regarding domestic and export requirements (see Vol. II, Part II, Chapters 1 and 2) and taking account of possible alternatives, possible productive guidelines to be followed in the short and medium term are as follows:

a. Increase and stabilize cereal production: sorghum, maize and rice to meet domestic demand and reduce imports.
b. Increase meat production (especially beef) to sustain and extend the present rate of exports, while increasing the size of the existing herds and the quality of the stock.
c. Improve quality and quantity of banana production to sustain and develop exports.
d. Increase sugar and cotton production to the point where no imports are needed.
e. Increase production of oilseeds to meet domestic demand, presently supplied by vegetable oil imports.

These guidelines also provide a reference frame for a long-term strategy to develop agricultural production, though they may have to be modified to suit particular needs which may emerge during the period considered (1976-2000).

The objectives could be achieved through:

- Implementation and development of modern irrigated agriculture in the districts indicated further ahead, the aim being to ensure enough basic production to meet export requirements, achieve import substitution, and improve availability of animal feedstuffs such as byproducts and forage.
- Improve rainfed farming in the remaining part of the Valley - after the irrigation districts have been set up - mainly around or within the districts, by providing an infrastructure which will meet local needs, at least to some extent.

3.3.2 Identification of Irrigation Districts

After having evaluated the potential of the lands suitable for irrigation and their geographic location, eleven irrigation districts were identified along the Juba. These have a total of around 233,600 ha of irrigability Class 1, 2 and 3 lands and more than 30,000 ha of Class 4 lands (see Table 7).

As regards geographic location and areas, these districts include those previously identified in the 1965 Juba River Irrigation Scheme, but, as already mentioned, evaluations are different regarding land classification, cropping patterns and crop calendar, crop production and irrigation water consumption.

The Table 7bis gives the basic data concerning the districts identified and their location is shown in the Figures. It should be borne in mind that part of the Class 4 lands included in District 6 cannot be irrigated or can only be irrigated at a very high cost. Thus it would be as well to consider that only 220,000 ha, of the about 265,000 ha, can be conveniently used within the next 30 years. Naturally, this presupposes that the flows of the Juba are controlled and that storage and distribution works are built.

In District 1 (Luuq-Dolow) which lies upstream of the Baardheere Dam, irrigation will depend on the seasonal availability of water from the river. Thus, it is apparent that there will be no perennial crops in the cropping patterns. However, taking the Valley irrigation projects as a whole, 95% of the total area will eventually be provided with flows controlled by means of the Baardheere and Saakow dams. And there it will be possible to have cropping patterns which include perennial crops and to be assured of the necessary quantity of irrigation water 9 years out of 10.

3.3.3 Feasible Cropping Patterns

The cropping patterns proposed for each irrigation district have been selected essentially to suit the soils and the climate, it being assumed that the necessary controlled flows of water will be assured in all the districts downstream of Baardheere dam.

Apart from perennial crops, for which special conditions must be respected in order to obtain the best results, there are no constraints as regards the other crops which necessitate their being grown in one district rather than another.

Table 7 - Irrigation Districts : Land Classification; Gross and Net Irrigable Areas

DISTRICT	Land class (ha)					Area served by irrigation network (ha)					Net irrigable area (ha)				
	Total	cl. 1	cl. 2	cl. 3	cl. 4	Total	cl. 1	cl. 2	cl. 3	cl. 4	Total	cl. 1	cl. 2	cl. 3	cl. 4
Luuq - Dolow	33,670	13,198	-	20,472	-	19,250	9,250	-	10,000	-	16,400	7,900	-	8,500	-
Baardheere - Saakow	132,490	5,985	126,505	-	-	57,000	4,200	52,800	-	-	47,350	3,550	43,800	-	-
Downstream of Saakow (1)	89,940	6,300	4,225	41,055	38,360	32,900	4,740	2,510	18,000	7,650	26,600	4,000	2,100	14,000	6,500
Downstream of Dujuuma	20,463	4,087	16,376	-	-	13,070	3,270	9,800	-	-	11,100	2,800	8,300	-	-
Dufalach - Afmadow	22,918	-	22,918	-	-	9,165	-	9,165	-	-	7,800	-	7,800	-	-
Faanoole - Jilib (2)	34,021	10,770	4,751	-	18,500	28,700	8,690	4,410	-	15,600	26,400	7,420	4,180	-	14,800
Toutà Island (2)	15,700	10,900	4,800	-	-	15,700	10,900	4,800	-	-	13,300	9,250	4,050	-	-
Baardheere - Ionte (2)	37,900	10,300	27,600	-	-	37,900	10,300	27,600	-	-	(3)32,200	8,750	23,450	-	-
Jamaame (2)	28,436	16,414	5,330	6,692	-	26,810	16,370	5,000	5,440	-	(3)20,050	12,200	3,750	4,100	-
State Farms (2)	13,734	5,133	46	-	8,555	12,300	4,600	-	-	7,700	10,300	3,900	-	-	6,400
Descek Uamo	18,740	-	18,740	-	-	11,800	-	11,800	-	-	10,000	-	10,000	-	-
Total	448,012	83,087	231,291	68,219	65,415	264,595	72,320	127,885	33,440	30,950	221,500	59,770	107,430	26,600	27,700

(1) In "Juba River Scheme - Moscow 1965" indicated as "Dujuuma District"
(2) In "Juba River Scheme - Moscow 1965" indicated with same name, but areas, locations and land classes do not coincide
(3) Including areas presently under bananas (5,025 ha) and forage (1,200 ha)

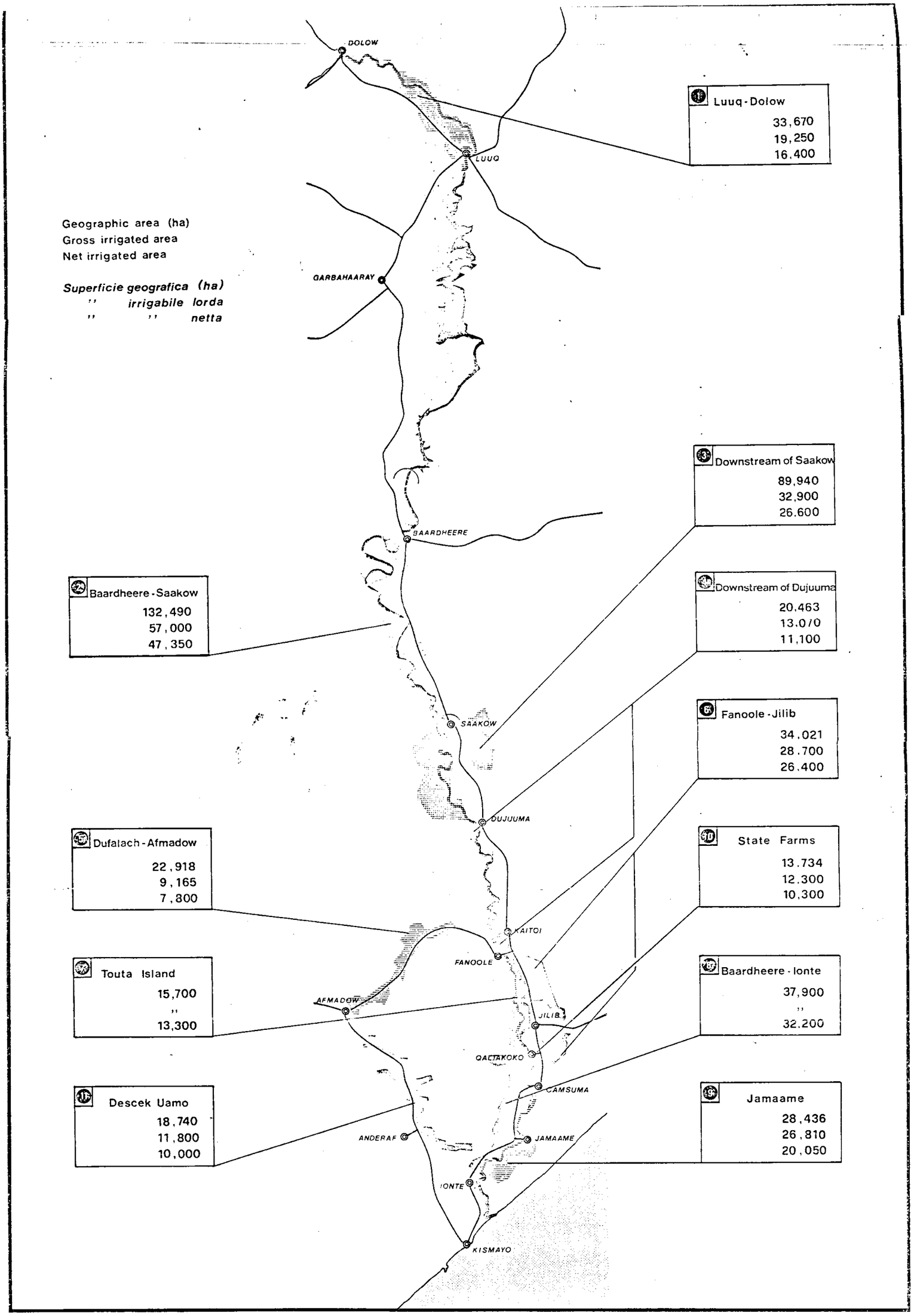


fig. 5

IRRIGATION SCHEMES LOCATION | *UBICAZIONE DEI COMPRENSORI IRRIGUI*

Table 7 bis - Net irrigated arable area - Perennial and rotated crops

District	Net irrigated area Ha	Perennial crops				Area for rotations
		Bananas	Citrus and others	Sugar cane	Total	
Luuq - Dolow	16,400	-	-	-	-	16,400
Baardheere - Saakow	47,350	-	100	6,375	6,475	40,875
Downstream of Saakow	26,600	-	-	-	-	26,600
Downstream of Dujuuma	11,100	-	-	-	-	11,100
Dufalach - Afmadow	7,800	-	-	-	-	7,800
Faanoole - Jilib	26,400	-	50	-	50	26,350
Touta Island	13,300	2,000	600	-	2,600	10,700
Baardheere - Ionte	32,200	5,525 (1)	200	6,375	12,100	20,100
Jamaame	20,050	8,500 (1)	200	6,375	15,075	4,975
State Farm	10,500	-	-	-	-	10,300
Descek Uamo	10,000	-	400	6,375	6,775	3,225
Totals	221,500	16,025	1,550	25,500	43,075	178,425

(1) Including existing bananas (Ha 5,025) and forages (Ha 1,200) cultivations.

For districts 6-10, the envisaged cropping patterns differ from those indicated in the 1965 Project because of the changed domestic and foreign market situations and also because of a different evaluation of the land potential, plus a more prudent assessment of irrigation water consumption and the processing costs involved in achieving the production objectives.

The schemes already projected or underway in the context of the 1974-1978 Development Plan have been incorporated in the envisaged cropping patterns.

It should however be emphasized that, in this case, the success of certain schemes, particularly those for the growing of bananas and sugar cane, will depend to a large extent on the construction of the Saakow flow regulation reservoir within a reasonable space of time, prior to the completion of the Baardheere Dam at a more distant date.

The cropping patterns are described in detail in Chapter 4, Part III of Vol. IV.

Irrigation is not practiced on a large scale in Somalia at the present time. The yields which it is thought can be obtained have thus been estimated considering the average bio-climatic conditions and by reference to conditions and experience in other parts of Somalia and in other countries where the situation is similar. It is assumed that there will be a gradual improvement in the physical and chemical properties of the soil and that proper cultural techniques will be introduced and adopted.

The cropping patterns indicated basically reflect the role each crop or group of crops has or may have in the economy of the Valley and of Somalia as a whole.

Export crops have been included in the pattern to the extent that they can be exported without great problems in penetrating foreign markets. In the case of seasonal crops, special emphasis has been given to cereals and oilseeds.

Textiles, vegetables and pulses have been assigned a role, which, it is felt, reflects their potential for expansion in Somalia. Within the context of the various groups, the role assumed by various species has been emphasized only in the case of cereals. In the case of the other groups, (e.g. oilseeds) the species are considered to be mutually competitive. The choice of one species or another will depend on yields of the varieties available (in the Juba Valley) and on organizational requirements.

Some groups (e.g. starchy plants) have not been included in the cropping pattern for the time being. It will only be possible to assess the role of these after trials to assess their competiveness with the other crops introduced during the present planning phase.

It has been felt necessary to introduce 25% of fallow in the cropping pattern each year (15% Gu and 10% Der) in the case of the mechanized farms and 20% (10% Gu and 10% Der) where the family farms are concerned. However, in certain cases, these percentages have been increased or decreased.

It is thought essential to rest the lands during this initial phase when they are being cropped for the first time. Fallowing the land is also very important inasmuch as it enables the peak requirements for machinery and labour to be reduced especially for the Der sowing and for the harvesting. As the years go by and organizational capabilities improve, the amount of fallow land can be progressively reduced.

Irrigation conditions in the Juba Valley permit great elasticity in rotations. By and large it has been decided to concentrate the crops with a long growing cycle in the Der period and also those which require a dry spell in the final part of their growth.

The total net irrigable-arable area is 221,500 ha, of which 43,075 ha will be given over to perennial crops and 178,425 ha to rotated crops. (see Vol. IV, Part III, Table 26).

Double cropping will be possible almost everywhere. Average crop intensity (ratio between harvested area and cultivable area) exceeds 1.7, variations from one district to another being quite small except for Jamaame which has the highest proportion of perennial crops.

Table 8 indicates the total area broken down by crop and district when production is running at normal level.

3.3.4 Organization of Production

As required by the Somali authorities (see also Vol. IV, Part III), future production will be organised around state farms, production cooperatives and family farms gathered into service and marketing cooperatives.

The breakdown by organizational types given in Table 9 stems from the technical and organizational assessments which have been made, taking account of the existing family farms, as well as those which it is expected will be created in some of the new districts to facilitate the settlement of farming families which, in certain cases, will have to be moved from their present farms.

The size of the family farms is determined essentially by the availability of labour and by the cropping patterns adopted, while the size of the state farms will depend on the cropping pattern, the cropping intensity and the amount of mechanization. It is envisaged that at least 60-65 broadly independent operational units will be required complete with the necessary operational equipment and qualified staff.

The family farms are on lands which are already occupied or which cannot easily be consolidated into large, efficient operational units (see Vol. IV, Part III, para 4.3). It is considered that the family farms will be gathered into some 250-300 1st and 2nd category service and marketing cooperatives.

3.3.5 Land Reclamation

Land reclamation will be performed as follows:

- Bush clearance

It will be necessary to avoid clearing bush of ecological importance (especially the gallery forest). The operation is restricted to the elimination of formations within the district and to ensure thin strips of land along the course of the river so as to be able to irrigate the best lands in their entirety.

Table 8 - Breakdown of areas by crop and district (in ha) according to basic cropping pattern (a)

Crop \ District	1° Luuq Dolow	2° Baardheere Saakow	3° Down-stream of Saakow	4° Down-stream of Dujuuma	5° Dufalach Afmadow	6° Faanoole Jilib	7° Touta Island	8° Baardheere Ionte	9° Jamaame	10° State Farms	11° Uamo	Total ha	Total %
CEREALS	13,300	38,140	37,730	8,850	4,730	27,210	8,500	14,525	3,600	5,150	3,680	(165,415)	46.5
Maize	4,500	17,800	1,085	3,900	4,730	6,450	4,600	7,925	3,600	5,150	-	59,740	
Sorghum	4,600	14,000	775	2,750	-	5,400	3,900	6,600	-	-	-	38,025	-
Paddy rice	-	1,900	35,250	-	-	15,000	-	-	-	-	-	52,150	-
Rainfed rice	-	-	-	2,200	-	360	-	-	-	-	3,680	6,240	-
Wheat	4,200	4,440	620	-	-	-	-	-	-	-	-	9,260	-
OILSEEDS	10,800	21,160	2,480	8,900	6,240	9,020	5,350	9,440	-	5,850	-	(79,240)	22.2
TEXTILE PLANTS												(19,660)	5.5
Cotton	1,100	1,900	-	-	780	730	1,300	-	2,400	3,900	-	12,110	-
Minor textile plants	1,100	2,850	-	-	-	1,090	-	2,510	-	-	-	7,550	-
FRUITS												(17,575)	4.9
Bananas	-	-	-	-	-	-	-	5,525	8,500	-	-	16,025	-
Others	-	100	-	-	-	50	-	200	200	-	400	1,550	-
SUGAR CANE	-	6,375	-	-	-	-	-	6,375	6,375	-	6,375	(25,500)	7.2
TOBACCO	-	1,900	-	-	-	1,460	1,000	1,900	1,170	-	-	(7,430)	2.1
PULSES	2,200	3,180	6,185	1,230	1,300	5,780	2,130	3,800	-	3,130	1,550	(30,485)	8.5
VEGETABLES	500	2,540	310	1,000	600	910	500	900	1,290	-	615	(9,165)	2.6
FORAGE												(1,800)	0.5
Maize	-	-	-	-	-	-	-	1,200	-	-	-	1,200	-
Alfalfa, Rhodes etc.	-	-	-	-	-	-	-	600	-	-	-	600	-
Total ha	29,000	78,145	46,705	19,980	13,650	46,250	21,380	46,975	23,535	18,030	12,620	356,270	100.-
Net irrigable area ha	16,400	47,350	26,600	11,100	7,800	26,400	13,300	32,200 (1)	20,050 (2)	10,300	10,000	221,500 (3)	=
Cropping intensity	1.77	1.65	1.76	1.80	1.75	1.77	1.60	1.46	1.17	1.75	1.26	1.61	=

(a) Indicated as Alternative E in Vol. III, Part III Table 1 concerning irrigation water requirements.
(1) Including area already under bananas (1,525 ha) - (2) Including area already under bananas (3,500 ha) and forage in the Trans Juba Project - (3) Including areas indicated in notes (1) and (2).

Table 9 - Organization of production

District	Family Farms		State Farms or Cooperatives	
	No.	Ha	No.	Ha
Luuq - Dolow	1,925	5,000	3	11,400
Baardheere - Saakow	1,350	3,200	15	44,150
Downstream of Saakow	1,145	3,100	8	23,500
Downstream of Dujuuma	4,430	11,100	-	-
Dufalach - Afmadow	-	-	3	7,800
Faanoole - Jilib	625	1,800	9	24,600
Touta Island	-	-	5	13,300
Baardheere - Ionte	-	-	12	32,200
Jamaame	-	-	8	20,050
State Farms (1)	-	-	2	10,300
Descek-Uamo	-	-	2	10,000
Totals	9,475	24,200	67	197,300
%		10.9%		89.1%

(1) Project under way - 1975

- Grubbing

Grubbing completes the bush clearance work, freeing the ground from the roots which would otherwise hinder normal tilling operations.

- Rock clearing

In some cases, it will be necessary to clear stones from Class 2 and 3 lands which otherwise would not be completely arable.

- Rough levelling

Rough levelling is always necessary to ensure that the lands can subsequently be economically graded and laid out.

- Levelling

This completes the rough levelling and brings the lands to the grades most suitable for irrigation. The operation has to be done before lands are irrigated and should also be repeated periodically in order to ensure fully efficient irrigation and drainage.

- Breaking up

This is theoretically the last preliminary operation. In practice it is sometimes better for this operation to precede levelling. It generally serves to clear the last residues of roots from the soil and to facilitate aeration and penetration of water and roots.

When there have been major earth works, breaking-up is indispensable where the surface soil has been moved, and sometimes it should be repeated to help ensure a reasonable arable depth within a relatively short time.

In breaking up, the indications provided by the soil survey must be borne in mind. In lighter soils which are uniform in depth the ripper is certainly the most suitable, or at least the most economical, tool to use for the job.

It must be remembered that, in some cases, the nature of the deeper layers may be such that if they are brought to the surface they may worsen the qualities of the arable layer. In such instances too, the subsoiler will have to be replaced by the ripper.

On Class 4 lands it is apparent that the breaking-up operation should start with very shallow ploughing, gradually increasing the depth over the years as the water table is lowered and the salinity of the soil is brought to a more acceptable level by leaching and by corrective treatment.

- Windbreaks and roads

All the districts will be surrounded by 10 m wide windbreaks. Secondary and tertiary windbreaks will also be planted on the farms and along the roads. These are designed not only to protect the crops from winds, especially the hot winds, but also to provide a supply of wood, (which Somalia lacks) and shade. At the same time they will eventually help create and oasis effect, which can lead to a reduction in water consumption of around 20% in districts the size of those involved.

Each district is connected by main roads to the regional roads while the internal road system will provide ready access to the operational points for the equipment needed to till the land, while allowing produce to be hauled out without difficulty.

- Irrigation and drainage

Each of the eleven irrigation and drainage systems will have earth main canals, secondary canals and tertiary canals, complete with necessary structures, to carry the discharges and the water flows indicated previously.

These irrigation structures will supply water to the distributors feeding the individual irrigation units and leading to the smallest independently irrigated plots on which only one single crop will be grown. The size of these plots varies greatly, from a minimum of 0.5 ha on 3 ha family farms where 6 different crops will be grown, to a maximum of around 100 ha, on the state farms. At this stage only general indications can be given and schemes suggested, as shown in the figures of Vol. IV, Part III, Chapter 5. It is apparent that, in practice, the size of the single plots will depend on the landform and hence on the earthworks involved. However, the latter should be kept to a minimum to avoid complete removal of the topsoil, whenever possible.

The irrigation systems also include pumping stations. These are envisaged for the irrigation of the whole of the Luuq-Dolow district, for a part of the Baardheere-Saakow district, part of the district downstream of Saakow and that downstream of Dujuuma as well as the Descek Uamo. Pumping stations may also be used to provide an economic solution for local situations and limited areas which would otherwise not be irrigable. Such cases occur in the other districts. The costs of the works, with breakdown by district, are shown in Table 10.

3.3.6 Irrigation Water Requirements

The irrigation water requirements at the intake, net of estimated useful rainfall, have been calculated by applying parameters derived on the basis of the cropping patterns. The calculation has indicated the overall water requirement and the breakdown by district (see Tables 6 and 6bis).

Consumptive use of water by crops was determined by the Blaney and Criddle method, introducing the climatic data measured at Ionte in the case of the Lower Juba and those measured at Baardheere and Luuq for the Upper Juba. The higher values for the K coefficients were adopted. It is calculated that the irrigation efficiency will average about 0.60 at the farm turnout for all crops (except rice), since it is presumed that, in the initial phase, surface (gravity) irrigation will be practiced.

In determining consumption, especially for the first period, account has also been taken of the present consumption figures, which can however be reduced. The requirements thus determined do not include the quantity of water needed for leaching the saline or saline-alkaline soils. This figure will have to be determined separately, on the basis of the cropping calendars and the specific properties of the soil (see Vol. IV, Part III, para 5.2).

Losses by evaporation and by infiltration from large areas of water

Table 10 - Irrigation development : Cost summary (in '000 So.Sh.)

District	Area (1)	Preliminary works (2)	Network for		Road	Windbreaks	Engineering Contingencies	Total	Unit costs (3)
			Irrigation	Drainage					
Luuq - Dolow	19,250	60,240	50,980	24,700	28,700	11,250	66,950	243,000	12,623
Baardheere - Saakow	57,000	135,436	147,315	87,750	59,250	12,000	167,881	609,600	10,694
Downstream of Saakow	32,900	125,556	72,327	114,460	35,910	9,120	136,177	494,550	15,032
Downstream of Dujuuma	13,070	48,540	32,815	16,991	30,200	5,625	50,979	185,150	14,166
Dufalach - Afmadow	9,165	25,560	22,679	11,960	16,278	4,050	30,623	111,150	12,128
Faanoole - Jilib	28,700	42,336	65,547	81,090	15,300	2,250	78,077	283,600	9,881
Touta Island	15,700	48,830	28,539	20,410	15,310	2,700	44,011	159,800	10,178
Baardheere - Ionte	37,900	116,720	91,230	48,360	31,360	4,275	110,955	402,900	10,630
Jamaame	26,810	84,570	66,573	35,100	24,500	4,050	81,607	2[illegible],400	11,055
State Farms	12,300	3,090	30,243	67,990	8,650	1,800	42,477	154,250	12,540
Dessek Uano	11,800	23,380	29,250	15,340	19,440	4,500	34,932	126,850	10,750
Project area	264,595	714,438	637,498	524,151	284,898	61,620	844,669	3,067,250	11,592
%	-	23.3	20.8	17.1	9.3	2.0	27.5	100%	

(1) Served by irrigation net (ha) - (2) Including bush clearing - (3) Referred to gross irrigable areas (So.Sh./ha)

and from conveyance canals have not been included. Such losses can be minimized and/or eliminated by lining the conveyance canals or by adopting large diameter pipes. These losses have, however, been considered in the dimensional design of the hydraulic works.

During a later phase of the proposed scheme, it is expected that sprinkler irrigation and trickle irrigation will be introduced for specific crops in areas with the right kind of soil. This will ensure a big reduction in the unit and total water requirement.

However, a definitive decision on this matter can only be taken during the final design, on the basis of information from detailed soil surveys and the results of trials.

3.4 DEVELOPMENT OF THE LIVESTOCK SECTOR

3.4.1 Aims and Basic Premises

The introduction of large-scale irrigation in the Juba valley, with the creation of the eleven big districts, will eventually result in the doubling of productivity of the livestock (cattle and sheep in particular) which presently use the natural resources in this area. This result will be obtained by broadening and developing the activities already envisaged in the 1974-1978 Five Year Plan and by coordinating a whole series of new schemes in the Juba Valley for:

a. Improvement of the health of the livestock raised by the nomads and by the settled farmers.
b. Improvement of feeding conditions on the ranges.
c. Improvement of the infrastructure for the production and marketing of meat and animals on the hoof.

The most outstanding economic and productive results will be obtained only when most of the irrigation districts are more or less fully operational. However, the gradual implementation of a number of schemes affecting the Valley as a whole will also produce positive results in the short and medium term, while providing the basis for subsequent, more intensive development of the livestock sector.

3.4.2 Project Strategy

The 1974-1978 Five Year Plan provides for the implementation or rather, the initiation, of a series of important schemes which have, or will have, a mainly local effect.

Examination of the ongoing projects shows that as regards the south of the country it is planned to implement schemes especially in the health, market and the semi-settled stockraising sectors, (Trans-Juba Project). However, in order to achieve the intermediate objectives indicated above it will

be necessary to ensure coordinated implementation of the planned activities and those summarized below:

a. Improvement of the animal health situation, by putting the veterinary services into proper shape and ensuring they have sufficient equipment and qualified staff.

b. Improvement of the rangelands and the use thereof, by opening new waterpoints and adopting a rational policy for the use of rangeland and water, which should be supervised by regional commissions set up specifically for this purpose and by the range management services.

c. Training of stockraisers in improved animal husbandry techniques, progressive settlement of the nomads in pastoral units and the creation of groups of breeders specialising in the intensive raising of young stock and in the fattening of fully grown animals to produce good quality meat. Agricultural output from the districts along the river will provide the livestock sector with large quantities of byproducts, whose rational use will ensure the intergration of stockraising and agricultural projects.

d. Raising of milking cows by the farmers to cover family milk requirements and the raising of young animals to weight where they can be profitably slaughtered.

e. Creation of pastoral units for the permanent settlement of a certain number of herds, which for many years will have to be fed and watered from the irrigated crop areas.

f. Fattening of animals at the end of their career before being sent to slaughter. This will be done on the family farms or at special centres.

g. Raising of young animals (calves and lambs) on the open-stall system with a balanced diet involving the use of agricultural byproducts. This will be done on the family farms or at special centres.

h. Establishment of a station for the production of improved breeding stock achieved by selection, as the first stage towards upgrading stock quality.

i. Construction of a 20,000-ton/year slaughterhouse and cold store in the Upper Juba (probably at Baardheere) to produce high quality meat for export, chilled or frozen, and lower quality meat for canning.

The projects and activities described above, must be implemented on a progressive and continuous basis. In particular points a., b., c., and e. must be implemented to a coordinated time schedule, before the other points. It will be necessary to assess and define in detail the efficiency and suitability of the means which will be available, so as to select the best and cheapest methods to be adopted. It will be necessary to avoid embarking upon sophisticated programmes whose cost would be out of all proportion to the practical results it is wished to obtain.

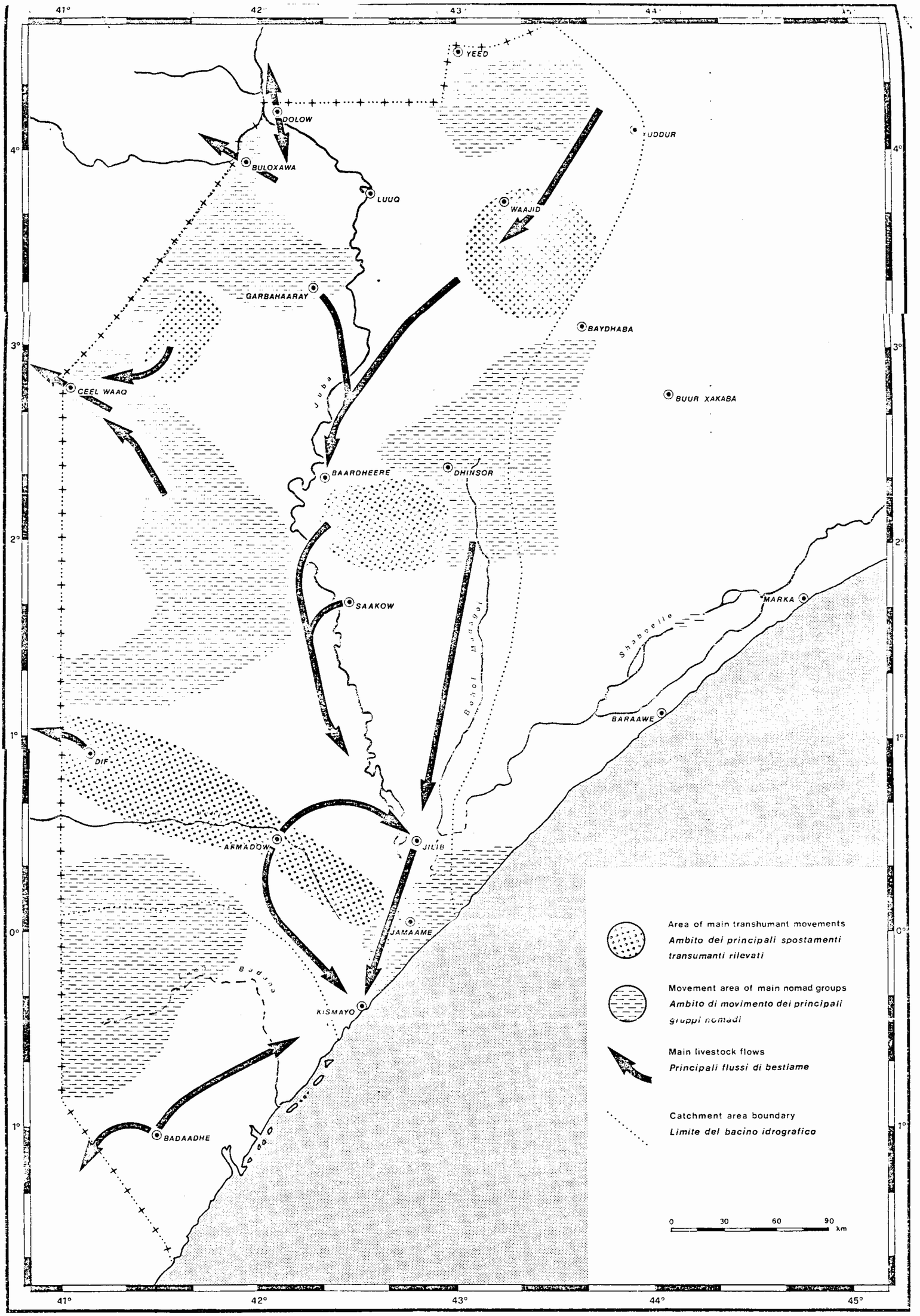


fig. 6

AREAS INTERESTED BY NOMADISM

AREE INTERESSATE DAL NOMADISMO

3.4.3 Improvement of the Health Situation

The diseases present in Somalia are known and ways of combatting them are available, though it must be admitted that for some diseases the efficiency of the methods is not one hundred percent. The control of health conditions will thus depend directly upon the veterinary service which should:

a. Implement a vaccination campaign for the prevention of the most dangerous endemic diseases which are: rinderpest, pleuropneumonia, foot and mouth disease, trypanosomiasis and tick fever in the case of cattle.

b. Exercise health control on the ranges, at watering points, markets and quarantine holding grounds.

c. Exert veterinary controls on herds coming from outside districts and those using transhumance trails near the frontiers.

It is thus necessary to progressively build up a series of centres, sub-centres and stations in the Valley (as indicated in Volume IV, Part IV, para 3.4) organised as follows:

a. In the regional capital there should be a regional veterinary centre or sector under the control of a qualified veterinary surgeon responsible for all matters concerning livestock. He should have one or two assistants and three or four vaccinators, depending on the number of head of stock concerned and the size of the territory.

b. In every district there should be a veterinary subsector under the control of an assistant, helped by two or three vaccinators.

c. There should be veterinary stations with a vaccinator (not as highly qualified a person as the veterinary assistant) everywhere there is any great concentration of livestock; the personnel could also ensure that the water regulations are observed, in addition to attending to the health of the stock, educating the herders and obtaining medicines for their cattle (products to combat intestinal worms, ticks and so on, for example).

It is a better policy to distribute staff at numerous points than to have them concentrated merely in the regional or district capitals. The more numerous and frequent the contacts between veterinary service officials and herders, the more efficient the service will be. Such contacts will also greatly facilitate the exchange of information and generate a climate of mutual confidence.

3.4.4 Improvement of the Environment

The 1968 FAO study appears to indicate that despite a relatively low overall potential, the rangelands of the project area could, in theory, carry more animals. They are underused at the present time because of the lack of permanent waterpoints in certain regions in the north and the centre and because of tsetse fly infestations along the banks of the Juba, as well as in the south and southwestern regions. All this means that enormous areas of rangelands cannot be used during certain times of the year, resulting in the

great transhumance movements that occur.

There is slow deterioration of the resources along the stock trails and excessive exploitation of the healthy regions or those provided with watering points. Here the soils become eroded and the less appetising types of grazing begin to take over. In other regions the rangelands are underused. A final point which should not be forgotten is the often deleterious action of the prairie fires, some of which are started accidentally and some purposely.

To improve this state of affairs it is necessary to open up new waterpoints and to transform into healthy rangelands the immense areas now invaded by scrub and trees and consequently by tsetse fly. There are few ways of doing this and these are very costly. For the moment the classical recommendations for improving rangelands are probably destined to remain inoperative. Thus the measures directed towards improvement of feeding conditions on the rangelands will consist essentially in:

1. Progressive extension of waterpoints through the whole area, following a predetermined scale of priorities.

2. Protection of rangeland production by intensifying the campaign to prevent fires (spontaneous or otherwise) and the indiscriminate use of trees and bushes as fuel.

3. Increased production of rangelands by eliminating weeds or other plants which are dangerous to livestock, bush clearing (when there is no danger of erosion), by designating areas which cannot be grazed, in order to promote reproduction of seeds of the more appetizing and nutritious types of forage and by regularly rotating rangelands.

4. Provision of supplementary feedstuffs during serious droughts (and hence when little forage is produced) in the form of concentrates and cattle-cake, obtained from the processing of agricultural products (oilseed cake, including cottonseed cake, rice husks, maize, sorghum and sugarcane leaves, bran and molasses).

The way of making this additional feed available would have to be decided upon.

A good policy to ensure implementation of these four points could be that indicated below.

Somalia will have nomads for a long time to come, because until the country has a closely-knit network of permanent waterpoints, general settlement will be impossible. Meanwhile, to economize on natural resources, a very clear distinction must be drawn between dry season and rainy season rangelands.

During the rainy season, grass and water can be found practically everywhere. Vast areas which are quite unusable during the dry season become available as soon as the rains create ponds in natural depressions. The herds must then leave the rangelands near the permanent waterpoints, which being protected in this manner, will be able to get back into good condition before the following dry season.

One point has been noted throughout Africa, namely, when there is a permanent waterpoint - especially if this is a mechanised installation - her-

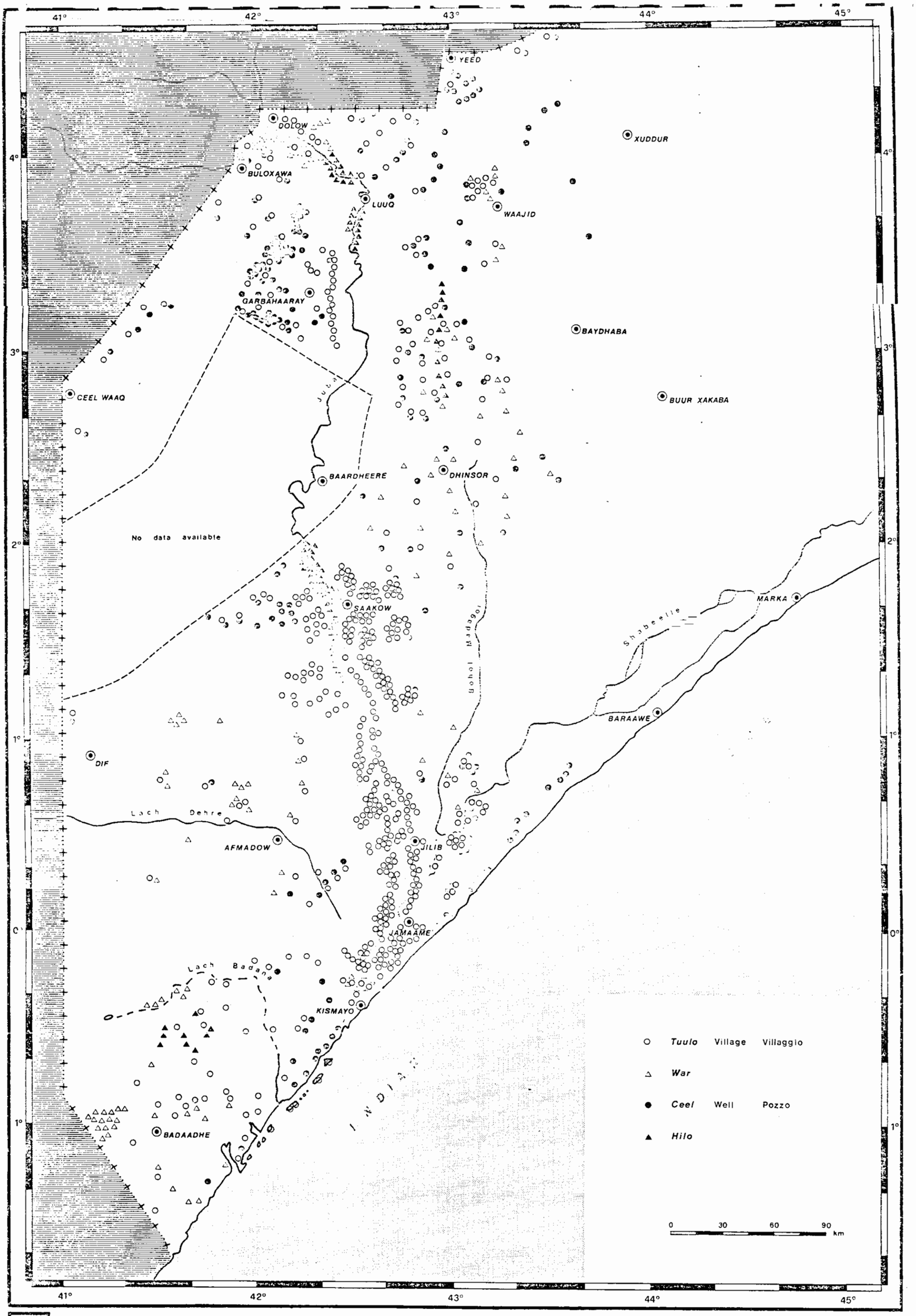


fig. 7

VILLAGES & WATERPOINTS

VILLAGGI E PUNTI D'ACQUA

ders have a tendency to choose the easy solution and remain near that point.

The result is that new grass which springs up with the rains is immediately trodden underfoot by the animals as it tries to grow, and no grazing is left for the dry season over a vast area around the waterpoint.

The animals must then seek nutriment over an increasingly large radius, returning to drink only every 2 or 3 days. Thus all the benefits which the new waterpoint could have brought are lost. In other words instead of the animals being able to find food and drink each day without having to move an excessive distance, as the dry season progresses, they must move further and further away to find grazing.

The regional control commission will be useful for ensuring that the policy outlined above is put into practice; indeed, it should be imposed, if necessary.

This commission should be composed of representatives from various groups of herders, who would have a perfect knowledge of the herds, the rangelands and of the waterpoints. Thus the commission should have no particular difficulty in preparing a plan for the equable distribution of rangelands. Members of the commission, presided over by the regional political commissar, should also have sufficient authority to ensure that their decisions are obeyed, enforced if necessary. At the start of the transhumance season, each herder would receive a transhumance card attesting to his identity, the number of head of stock and the composition of the herd, the area in which he is authorized to stay and the name of the waterpoint he must use. In this manner it will be possible to exercise control over transhumance and, if necessary, to take action against those who do not observe the rules. A proper water resources policy should permit the settlement of practically the whole of the country's population over the course of time. The ideal would be to have permanent waterpoints every 10 or 20 km with a dry season discharge of 20 - 25 m^3 per day. Each waterpoint would thus become the hub of a "pastoral unit" which would be used by a given group of nomads who would eventually come to settle there. The "pastoral unit" would have the following kind of structure:

- Permanent waterpoint, around which a permanent village would spring up, complete with fields growing subsistence crops to the extent possible.

- A dry season rangeland district, calculated on the basis of the yield of the waterpoint and the potential stocking rate of the rangelands; the district should not exceed 8 - 10 km in radius.

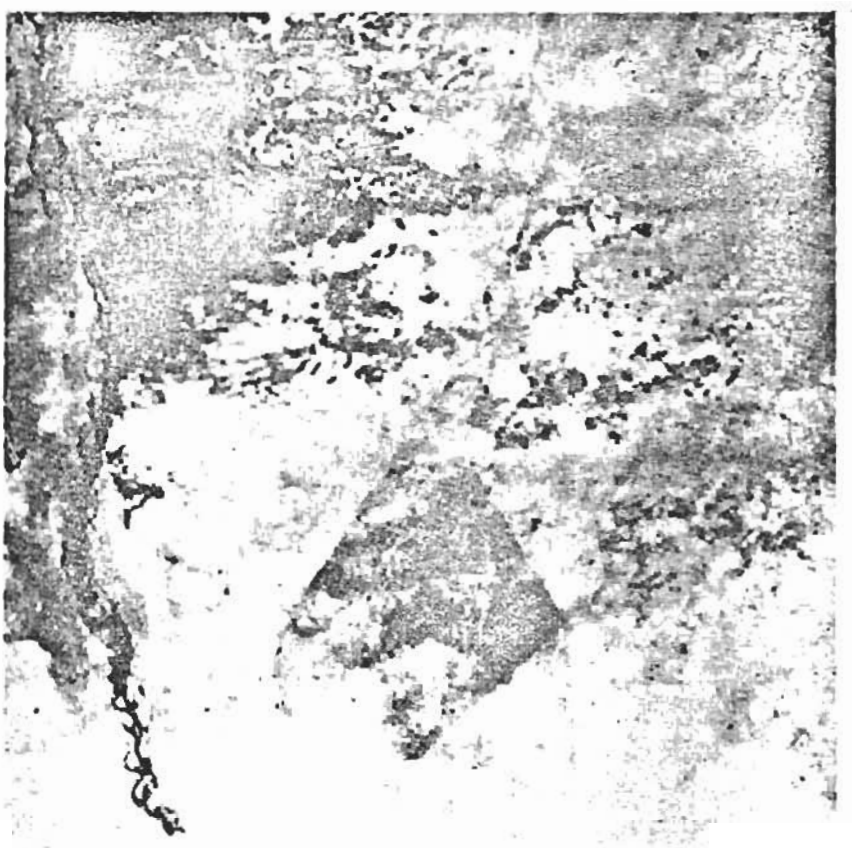
- Rainy season waterpoints, "ballehs" or "uar". As many of these waterpoints as possible should be built by unsophisticated methods inside and outside the dry season rangeland district. The livestock will stay near these waterpoints during the rainy season, (though it might well be that even the long-term presence of herds around one or two of these waterpoints during the rainy season will have adverse consequences).

It could well be that grazing might have to be prohibited on a certain portion of the rangelands each year in order to ensure a reserve of food, should the rains fail or be only partially effective, as can so very

This picture, taken by a remote-sensing satellite, dramatically emphasizes the effects of overgrazing on the environment. In a large area of a sub-desertic region (Sahel), that has been fenced for the purposes of an oil-drilling company, the vegetation has grown again, covering the desert with an uniform darker mantle.

Considering then the effects that these alternations seem to produce on the microclimate (mainly on rainfalls) it is easy to understand how such a phenomenon is likely to evolve itself up to the most important consequences.

(From "Futurist", august 1976)



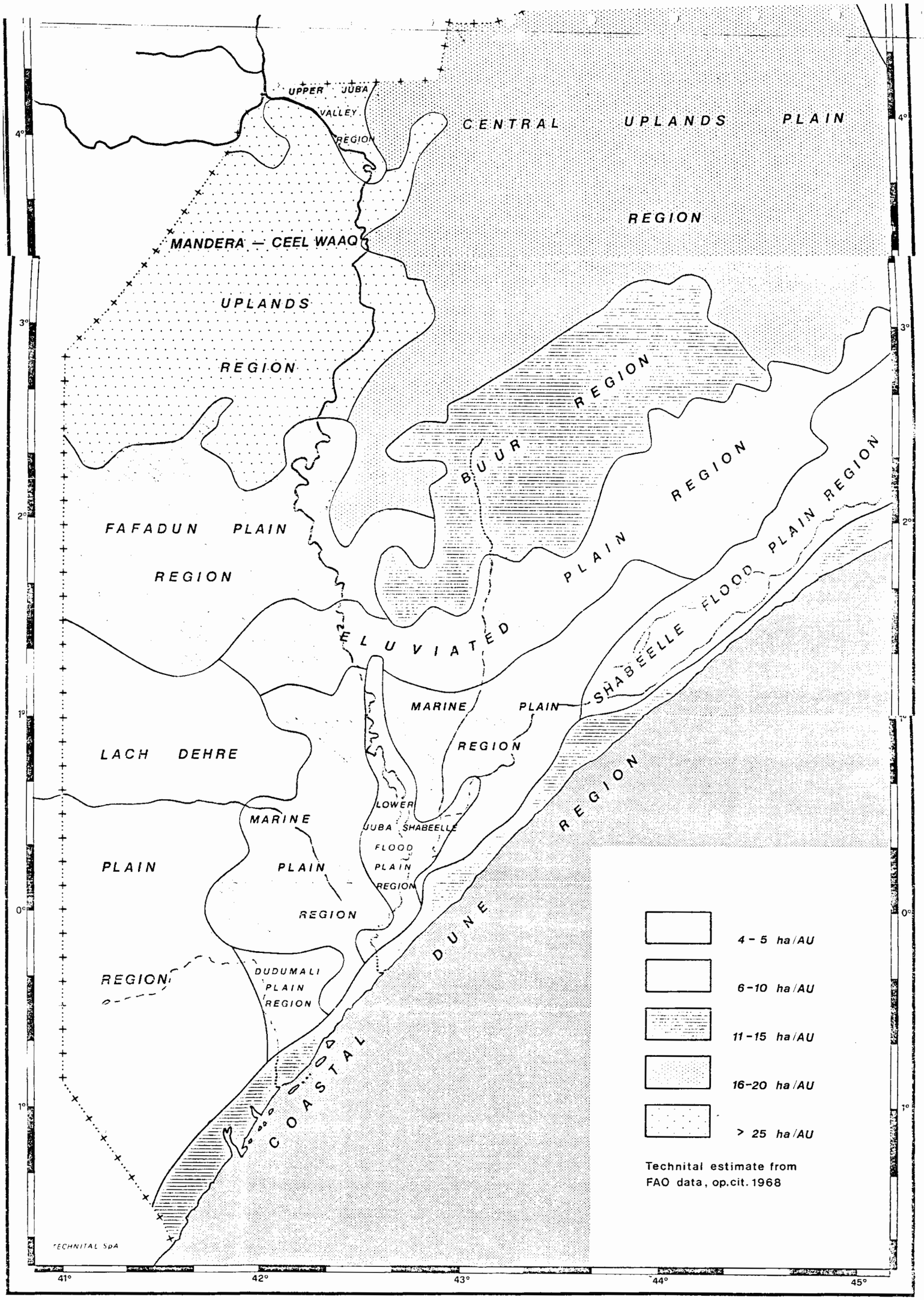


fig. 8

POTENTIAL STOCKING RATE | *CARICO POTENZIALE DI BESTIAME*

easily happen here. By adopting this approach it would be possible to keep the cattle in good condition throughout the year, while making rational use of the ranges and water. Damage would be prevented to the rangelands and the herds themselves would gradually be built up.

There would be a vaccinator or range management agent at each of these pastoral units to look after the animals and to supply the herders with medicines to cure intestinal worms and keep down ticks. The person concerned would see to the proper management of the rangelands and would ensure that the area around the permanent waterpoint was evacuated at the end of the dry season, leaving just a few milking cows in the village.

3.4.5 Improvement of the Production and Marketing Infrastructure

The major guidelines for improving the conditions of production and marketing sectors include:

- The setting up of markets where animals for fattening, or already grown-up, can be bought and sold.
- The improvement of stock trails linking rangelands to the waterpoints.
- The establishment of assistance centres for the distribution of supplemental rations, for the dissemination of information on rangeland and waterpoint conditions and for the distribution of improved breeding stock.

It will be essential to open new markets. However it would be a uselessly costly exercise to build "luxurious" markets with holding grounds for buyers, sellers, auction yards, etc. All that will be needed will be three well-protected enclosures for cattle, sheep and camels, large enough to suit the importance of the market. This would ensure considerable economies.

Services

- Veterinary Service staff

The Veterinary Service must be dynamic. It must always be on the more, always making contacts with the herders. By maintaining close contacts it will be possible to make the herders very quickly understand the importance of vaccination and of various disease-prevention treatments and get them to adopt more modern productive methods of stockraising.

This is the reason why it is recommended that the Veterinary Service staff must be in the field, rather than concentrating them in the regional and district capitals.

As far as possible, the staff should stay on the same site for a good many years, so as to get to know the area, the people and their specific problems thoroughly. Excessively frequent changes of personnel will be counterproductive.

The veterinary assistants and vaccinators should be taught some simple, practical notions of agrostology if this has not already been done, so that they will be in a position to appreciate the nutritive value of rangeland and the ways of preserving its potential. They will thus be able to

provide efficient assistance to the Range Management officers whose numbers appear to be far not sufficient.

- Range Management Service staff

It is not possible to ascertain exactly how these officers are trained. Advanced training is certainly not necessary for field workers. Young people who have been to small agricultural schools would appear to be ideal, especially if they are taught something about botany, livestock and agrostology. They would automatically do their own apprenticeshp and they should rapidly acquire experience which would make them particularly useful to the herders, on such matters as the protection, conservation and utilization of rangeland.

A Ranger Corps could also be set up. This would have civilian personnel (technicians and operators) organized on military lines. They will attend to the complex activities of providing information, help and control briefly indicated above. Health control and the protection of rangelands and waterpoints alone would justify the creation of such a Corps.

3.4.6 Measures Connected in the Implementation of the Irrigation Districts

The object of the measures indicated here is to ensure steady output of beef and young steers for export to improve the quality of the existing herds. Two separate, but interconnected lines of action are envisaged.

First, the establishment of stations for the production of improved breeding animals (Boran and Sahiwal zebu) to be distributed among the best of the nomadic herders - in the manner to be decided - as replacement cattle in the transhumance herds.

Second, the establishment of centres for raising young calves (from 8 to 12 months) bought from the nomadic farmers to be fattened to 200 kg by 22 - 24 months, plus centres for fattening animals to a weight of 370 - 400 kg i.e. a useful weight for slaughter.

Thus, in a typical complex it will be possible:

- To produce 2,000 grade bulls annually to be distributed to the herds as replacement animals. Each year 100,000 cows could be served producing an average of around 60,000 improved Boran calves.
- To produce annually around 35,000 tons of beef, mutton and goat meat (standard carcass).
- To reduce the stocking rates and improve rangeland use by purchasing young male calves less than one year old, thus enabling the number of breeding animals on the rangelands to be increased.

The number of head of stock in a herd depends essentially on the environment and its potential. It has already been seen that there are some obstacles, such as the shortage of water and especially the presence of tsetse fly which hinder the complete utilisation of this potential at the present time.

Consequently, the number of head of stock can only be increased as these various obstacles are gradually eliminated. However, the implementa-

tion of the irrigation project will enable the productivity of herds to be improved, perhaps without any increase in the number of animals.

At the present time, because of the prolonged drought over recent years, it is very possible that the herds are still in the restoration stage: normally the number of breeding cows is being built-up again. The young cows are being kept, as are the old cows which are still capable of calving. Consequently, productivity does not exceed 8-9%, which means an annual production of around 100,000 head, young animals and animals at the end of their career. According to estimates made in the project area, on 1,200,000 head, this situation will continue for another 2 or 3 years, after which productivity will return to its normal rate of 11-12% or 130,000-140,000 head per year, a good part of which will be young males less than 3 years old.

Until the new structures mentioned previously are created, the situation in the herds will remain unchanged (in other words, the fertility index will remain around 60% and the mortality rate around 35-40% for calves less than 1 year old, 15-20% for animals between 1 and 2 years old, 5% between 2 and 3 years and 1% a year for animals over 3 years old).

As the project work gradually gets done and there is an improvement of livestock structures and a progressive increase in irrigated agriculture, the state of the herds will improve and it is reasonable to expect that the following objectives will be obtained:

- Towards 1980: fertility index of 65%; death rate: 30% for calves less than 1-year old, 12% for 1 to 2-year old animals, 3% for 2 to 3-year olds and then 1% per annum.
- Towards 1985: fertility index: 70%; death rates respectively: 25%, 10%, 2% and 1% annually.
- Towards 1990: fertility index: 75%, death rates respectively: 25%, 8% and then 1% annually for calves over 2 years of age.

This is just a question of the increased productivity of the country's livestock population which, in 20 years, should rise from 10-12% to 15-16% or even 20% depending upon the hypothesis adopted.

In the first hypothesis, it has been considered that sales start from 3 years, an average which takes account of the fact that while some immature males are eliminated, other animals which should have been sold long ago will still remain in the herd.

In the second hypothesis, progressive changes in the methods of stock-raising are envisaged so that eventually there will be two or even three classes of stockraisers:

1. Stockraisers specializing in the breeding of weaned calves. These will be mainly herders who have only breeding animals in their herds, mainly young ones, calves less than 1 year old, young replacement cattle and sufficient bulls for the number of cows; in other words, these stockraisers would have a greater number of breeding cattle, produce more milk and face less risk of catastrophe in the event of prolonged drought.

2. Stockraisers specializing in fattening calves. The animals would be brought up from a weight of 90 - 100 kg to 300 - 320 kg in a year and a half approximately (a weight increase of 400 gr per day).

3. Stockraisers specializing in fattening animals for slaughter. This would be done in a period of 2 or 3 months, the animals concerned will consist of fattened calves from the fatstockraisers and of beasts at the end of their career and ready for slaughter.

It will only be possible to increase the size of the herds progressively, as new permanent waterpoints are set up (thus permitting the settlement of nomads in "pastoral units", so that all the natural grazing land available can be properly utilized).

Then, according to FAO estimates the number of animals in Somalia could more or less be doubled.

3.5 SCHEMES IN OTHER PRODUCTIVE SECTORS

3.5.1 Industrial Policy - Industrial Development Sectors

The economic objectives and the economic choices which form the backbone of the development plan for the country as a whole and the Juba Valley in particular are described in Chapter 2 of this Volume. The 1974-1978 Five Year Development Plan gives important detailed indications on the role of industry and the development guidelines for this sector. The following factors have a major bearing on the definition of this role:

a. The basic choice to ensure a balanced rise in the standard of living and also the extent of the people's participation in consumption and in the modern sector of the economy.

b. The realization that with a growing economy and the present level of development, Somalia will be dependent upon foreign countries for a long time to come for capital goods, sophisticated consumer goods and technology.

c. There will continue to be a balance of payments problem, owing to this unavoidable dependence, even when Somalia is fully selfsufficient as regards food and is fairly well on the way to sufficiency where the simpler consumer goods are concerned.

Scrutiny of many sectoral studies made in these last few years (particularly the UNIDO report of 1973) and a year-long examination of the position in the Project Area, confirm this role that has been cast for industry and also the guidelines that have been laid down. It is thus apparent that development efforts will have to be concentrated on three key aspects:

1. Processing of agricultural products.
2. Production of consumer durable goods, agricultural implements, and first-priority instrumental goods.
3. Production of construction materials.

Many investigations have still to be carried out in the region (which is one of the least systematically explored in the country) to assess what other natural resources, such as minerals, it possesses. The positive outcome of any one of these investigations could profoundly change the regional industrial prospects and spark off a cycle of processing schemes the perspectives of which are difficult to define.

An important mineral discovery could make the construction of a huge transport infrastructure economically possible: this could profoundly alter the many infrastructural constraints which have so far been accepted as independent regional planning variables. This study takes account, at a qualitative level, of some of the more probable possibilities.

In the first phase no effort will be made to substitute present cottage or handicrafts industry with highly mechanized industry but rather to make best use of the aboundant supply of manpower. Indeed, even at the expense of extremely low productivity the choice will still be for a labour-intensive approach. The problem of the so-called "alternative technologies" (those more suitable to the overall objectives of incipient development), starkly faces every country whose industrial development must start in the dependent conditions so typical of the Third World. The international unification of technology in the developed countries often offers no real alternative. However, it is possible to try to choose the sectors, product presentation techniques and products bound up with the specific realities and requirements of the country. The substitution of labour, dependence on the international regime of prices and permanent import of know-how must be limited. Although the solution may be difficult to find for products which will also be exported (quality standards are often linked to the sophisticated automated processes (1)) it is much less so for products for which there is a wide domestic demand such as foods, textiles and implements. The fact that many of the industries will be established in agricultural production centres means that for infrastructural reasons no unnecessary complications must be introduced.

In deciding on products within the sectors mentioned, use has been made of the results of other planning exercises in this study, especially as regards agricultural production, the location thereof and expected growth trends. A by no means minor difficulty is the time horizon which the Somali government has set for this industrial planning, i.e. 20 years. Though this period may be normal for a hydraulic or agricultural infrastructure, it is an extremely long one for industry. Moreover, dependence on outside sources (for material, plants, fuels, etc.) weighs far more heavily on the industrial sector. The effect of recurrent fluctuations on international prices is thus more direct and the planning uncertainties are greater. It will therefore be apparent that many of the proposals which follow provide only a guideline and

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(1) Especially food products and the way they are packed, etc, the standards and the uses of colouring agents and additives and, in particular, certain meat and fish products as well as fruit and vegetable products and their derivatives.

serve merely as examples. Only on moving from the planning stage to the actual design of the irrigation district will it be possible to frame an appropriate industrial plan.

3.5.2 Industrial Projects in the Juba Region

For each of the three sectors mentioned above we have listed groups of projects to be implemented either immediately or in the near future. In all cases, the time horizon depends on the availability of the envisaged agricultural production upstream or of the outlets envisaged for products downstream. A list of non-immediate projects has also been prepared. The feasibility of these depends both on investigations as to availability and on whether market conditions remain as they are at the present time. The results of the studies in other sectors of development to which industry is linked for its inputs or as a source of demand lead to the same conclusions as noted, the related sectors, are, basically, agriculture and forests, livestock and fishing and construction (for dwellings and for transport infrastructure). Some of the listed projects are not bound up with any one region, but it is suggested they be located in the Juba Valley to ensure national economic and structural equilibrium. The industrial profiles, i.e. the dimensions and descriptions of the most important of the projects identified, are all given in the sectoral report (Vol. V).

A. Consumer durables or capital goods presently important:

A1 Decidedly of immediate interest.

a. Gypsum pilot plant at Luuq.
b. Factory for the production of agricultural implements, with its own foundry at Kismayo.
c. Industry producing ceramics for domestic use.
d. Factory making nails and the like.
e. Repair and maintenance workshops (3).
f. Shipyard at Kismayo.
g. Fertilizer blending and bagging plant at Kismayo.

A2 To be studied in detail, being of general interest.

h. Textile factory in the Baardheere area.
i. Glassworks and porcelain factory.
l. Truck and tractor assembly plant.
m. (1) Bicycle factory.
n. Electric motor and pump factory.
o. Engineering works and foundry at Baardheere.
p. Furniture works.

B. Agricultural products processing industry.

B1 Decidedly of immediate interest.

a. Expansion of the meat processing plant at Kismayo and possibly a new plant in the Middle Juba (also utilizing byproducts, such as bones, blood, etc.).
b. Sugarmills (2) in the Lower Juba (Ionte and Jamaame areas) processing 400,000 tons of cane each with alcohol production unit.
c. Sugarcane-pulp industry for paper production.
d. Slaughterhouses with cold stores (2) one in the Middle Juba (6,000 tons carcasses/year, possibly utilising byproducts as well)-(to be coordinated with point a.)-and one in the Luuq area (5,000 tons carcasses/year).
e. Hides and skins units in the Middle Juba and/or at Kismayo.
f. Cotton ginnery.
g. Oilseed expressing plant (soya, cotton, sesame, groundnuts and sunflower) in the Luuq area (35,000 tons seed).
h. Sisal fibre and banana industry at Kismayo.
i. Dairy and milk processing centres at Kismayo.
l. Grain mills in the Baardheere area for 5,000 tons a year wheat and 20,000 tons of sorghum.
m. Mills and feedingstuffs plants.
n. Rice and maize treatment plants in the Faanoole area (miscellaneous small plants).

B2 To be studied in detail, being of general interest.

o. General treatment and storage plant at Kismayo with fishmeal and fishoil units.
p. General centre for fish treatment and storage at Marilé.
q. Fruit and vegetable processing and canning plant at Baardheere.
r. Tobacco drying plant.
s. Rice paper factory.
t. Gelatine and gum factory.
u. Oilseed expressing plant in the Faanoole-Jilib area (20,000 tons).
v. Banana processing and dehydration plant.
w. Sugarmill at Baardheere (processing 500,000 tons of cane).
z. Rice and maize processing plants in the Baardheere-Saakow area (various small plants).

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(1) The Italian alphabet is used for the index, as in the original. This has no j, k, x, or y and so these letters do not appear in the English version either.

C. Construction materials industries.

C1 Decidedly of immediate interest.

a. Plant for cement tiles and cement products.
b. Brickworks (probably in the Dujuuma area).
c. Ceramic tiles and sanitaryware factory (to be coordinated with A.c and A.b).

C2 To be studied in detail, being of general interest.

d. Cement works at Baardheere.
e. Factory for asbestos-cement products at Baardheere.
f. Panel-making unit.
g. Wood and furniture factory (see A.o).

Apart from cement, glass and ceramic, no other sectors involving the use of mineral products have been considered in the list because of uncertainties regarding the economics thereof. However, there are high hopes for some materials and should these be realized, they would give a great boost to regional development, not least because they would make some large transport infrastructural items economic. One of the main talking points in the past has been the iron ore deposits in the Buur area, others have been radioactive minerals, bauxite and asbestos.

For calculating investments and production in general, projects of the A1, B1 and C1 groups have been considered close to implementation, and have been included in the development programme. In the case of products dependent on bringing the irrigation areas into cultivation, we have endeavored to fix the industrial investments to match the phasing of the schemes. Where projects of groups A2, B2 and C2 are concerned, the broad estimate of investments and production for the longer term covers about half of the units proposed (see Sectoral Report).

3.5.3 Development Poles and Infrastructural Implications

The breakdown of the large Juba Valley development into irrigation districts and the consequent distribution of population and the relevant infrastructural needs and possibilities have been analysed to obtain an initial outline of regional organization and planning (see Vol. V, Part I and Vol. VI, Part I). The ensuing scheme consists of a series of poles (or nuclei of attraction and concentration) around which hinges the industrial structure. If the initial number of development poles is fixed at between 4 and 6, this will permit considerable economy scale both as regards the direct infrastructure, (electrification, water, transport centres) and the indirect infrastructure too (skilled labour, social services, maintenance and outside technical services, etc.), even allowing for the limited degree of sophistication and intensity of investment proposed. Together the poles will ensure balanced coverage of the whole region.

The two natural regional poles are Kismayo and Baardheere, the former because of its size and obvious commercial importance and the latter because

of its prospects, as it will be near the main dam and not far from the second dam (Saakow). Baardheere is also centrally placed economically in the envisaged infrastructure. A not improbable mining development in the Buur Area would further enhance the importance of the west-east axis with Mogadishu, while agricultural development of the Inter Rivers Area would also do likewise, though the alignment of the axis would be slightly different.

Two other concentrations that could easily be made into poles are the Jilib-Faanoole and the Dujuuma-Saakow areas. These are preferential locations for many reasons, not least because they lie on the north-south axis of the Juba Valley between Baardheere and Kismayo. Both areas are distinguished by the extent and the wealth of the surrounding districts, and by their proximity to large hydraulic works. They have already been chosen as settlement areas for refugees from drought-striken areas.

The choice of the fifth pole would seem to fall naturally on Luuq, both for reasons of regional balance and because of its relative economic importance and also for the presence of a third clearly recommendable alignment which runs northwest and southeast, taking in Baydhaba and Mogadishu.

The identification of the poles involved taking into account energy requirements, to be partly fulfilled by the hydroelectric plants of limited size which shall be built on the river (see Vol. V, Part I, para 4.1 and 4.2). Thus, to summarize, we have:

-	Main poles	1) Kismayo 2) Baardheere
-	Important poles	3) Jilib-Faanoole 4) Dujuuma-Saakow 5) Luuq

All the other crop-growing areas will be able to benefit from smaller plants, some for ensuring the first treatment of products and others for satisfying the simpler consumption demands.

3.5.4 Small Scale Industry and Crafts

According to the International Agencies, small scale industries are all those industrial activities which do not require major investments or those which comprise a small group of workers or again, those where the figure of the manager is not clearly distinguished from that of the producer. The sector is studied separately because of its special characteristics and because of its prime importance as a first step towards the creation of an authentically national industry; in addition there are, of course, the other obvious factors involved, such as diversification, diffusion and the revival of craft capabilities and traditions.

As far as this study is concerned, the points made regarding the manufactured products sector hold good for the small-industries sector too, (the crafts sector merits separate consideration).

In general, the partially self-sufficient nature of the district agricultural communities should favour the growth of small industries. The use of small family plants for rice milling and for expressing oilseeds,

(handling some 60-100 tons/year) are common in developing agricultural economies in southeast Asia and in various parts of Africa. These are very efficient for satisfying the needs of local consumption.

To date, the crafts sector in Somalia has not found the right conditions for proper development, and the indications given in the Five Year Plan are not very clear. The importance of certain types of traditional and artistic crafts lies in the very low level of investment needed and the large amount of direct and indirect employment that can be provided, especially since no particular or difficult-to-acquire skills are involved. The main problems, therefore, lie in the organization of production and in placing the products on the domestic and foreign markets; this calls for particular care as regards product presentation.

When investigating this sector, all the existing craft cooperatives in Mogadishu were visited. Though this type of organization seems to be the best, for a highly urbanised area, cooperative farms must be carefully examined in the rural context to assess the feasibility of organizing scattered productive units. The solution to the organizational aspect may well lie in setting up a few centres with the following functions:

a. Supply the raw materials where these are lacking or difficult to come by.
b. Indicate the desired quality standards and designs.
c. Collect the products to send them to distribution centres.

These support centres should be incorporated in the structure of the Regional Plan, while the distribution should be handled by a central organization. In the case of foreign marketing, for example, this might be done by the Chamber of Commerce, which has already acquired some experience in this matter, though any other suitable organization would serve equally well. Much preparatory work will have to be done to promote the crafts sector. The road will be long and hard, because the present level of traditional and artistic crafts in Somalia is low. Rather poor, not very suitable materials tend to be used, and the designs are not particularly interesting, nor do they fully reflect the country's heritage which can be seen in the Mogadishu Museum. Prices are high and the workmanship not very good. There are no proper export channels at the present time and the products are rarely displayed at international exhibitions or fairs.

3.5.5 Tourism

Because of the special social and cultural conditions in Somalia, tourism in the project area cannot be viewed in the same light as it generally is elsewhere. Apart from providing a source of valuable foreign exchange, tourism can also constitute a way of generally fostering the interchange of ideas with other countries and of introducing the Somali to his own country.

Tourism must not be thought of as a trade, but as an activity; not merely as a way of filling leisure time, but as a planned part of social development. There must be no disproportionate expenditure on services and infrastructure, the social cost of which has to be borne by the community.

Though tourism is not an absolute priority, it is a good way of mak-

ing most of the Juba Valley's scenic and wildlife resources. As such, it should certainly be developed within the context of medium and longterm plans. Thus those concerned with national security should specify the constraints considered necessary, issuing precise statements so that the tourist knows exactly what restrictions there are on his freedom of movement, the use of firearms and so on.

There is no doubt that the Juba Valley has all the prerequisites for planned development of tourism. The Bagiumi Islands and the coastal belt are ideal for tourists, with the sea teeming with fish, the sandy beaches and the lagoons and pools just behind the dune ridge. Then, of course, there is the savannah with its wealth of wildlife, one of the richest areas in Africa in this respect.

The Ministry of Tourism and the Forestry Department programme for making a census of wildlife and for ascertaining the migratory movements thereof in southern Trans-Juba, is a very laudable first step towards setting up a real national park. However, this project and others, which should be performed, must be coordinated by an organised development programme so as to avoid those typical errors which occur so often in the case of isolated development schemes and individual fragmentary projects that lack a main reference framework.

It is important to draw up a general plan in the short term, to make coordinated use of the tourist sector potential and to provide the necessary structures to ensure planning harmony.

There should be no real difficulty in assessing the potential demand once the qualitative and quantitative aspects of the supply have been ascertained. The tourist aspect should also be coordinated with plans to stimulate the production of the traditional arts and crafts for export and with the particular measures for safeguarding and protecting the points of contact between wildlife areas and those where agricultural or livestock projects will be promoted. In this way it will certainly be possible to achieve economies of scale by interconnecting measures and projects which might otherwise be considered autonomous.

In the case of wildlife, the Five-Year Plan does no more than frame some very broad proposals.

The areas of greatest interest in planning terms will be those around the reservoirs to be constructed, especially where the nature of the land does not permit agricultural development, but only the growth of bush or perhaps not even that. Basically, it is possible to envisage a set-up which could be as follows:

a. A vast national park in the southern part of Trans-Juba, as is presently being studied by the government, including a completely protected area where there would be no human settlement or domestic animals.

b. Some parks or smaller areas where environmental conditions are favourable, along the main course of the Juba, and in areas that are not of priority interest from the agricultural aspect, (see Para 3.7).

c. Other corridors or passages between cultivated areas which must be adequately protected both as regards the infrastructure (canals, pumping stations, etc.) and in order to allow wildlife free access to given sections of the river.

d. Specific integrated reserves around the shores of the reservoirs.
e. Support and control points on game trails.

The form to be taken by each of these schemes will have to be indicated in the regional plan, bearing well in mind the aims of the 1974-1978 Five Year Plan. However, some precise indications are given here in Para 3.7 which deals with protection of the natural environment.

It is almost superfluous to underline the real tourism possibilities offered by natural parks and game parks. The introduction of man-made lakes often has the effect of improving upon nature. The huge success with tourists of the Lake Kainji area in Nigeria and Akosombo in Ghana, as well as of Lake Nasser between Egypt and Sudan, not to mention the Neuquèn lakes in Argentina, in quite another setting, provide concrete examples of this.

Regarding the possibilities of the Coast, the Bagiumi Islands have been mentioned and the beach area near Kismayo. The same applies also to the eastern coast up to Baraawe, where the exceptional beauty of the urban environment enhances that of the natural environment. A strict plan to protect the old town and the coast is needed now that the settlement of nomads has given a new impetus to economic and building activities.

At this stage, it is relatively easy to sketch-in a tourist itinerary embracing Mogadishu, Baraawe, Kismayo, Lower Juba, Baardheere and back to Mogadishu. This itinerary could be equipped with stop-over points (holiday villages or chalets with central services). Four or five such facilities would suffice at the points. A typical tour could be: by road from Mogadishu to Baraawe and Kismayo, by road to Lower Juba returning to Jamaame, a mixed road-river section up to the Saakow and Baardheere lakes and by air from Baardheere to Mogadishu. The safari could easily be framed to include a longer stay, say a week, at the seaside resort at Baraawe or in the Lower Juba, thus providing a two-week package vacation with charter flights, from Europe.

This package could be sold through European tourist agents to ensure continuous utilisation of at least part of the beds provided at the stop over points indicated.

It is appreciated that competition amongst African countries and the increase in air fares after the 1973 oil crisis has redimensioned tourist development prospects which looked extremely bright after a number of local "booms" in the 60's (for example in Kenya). However, in the long term, tourism should certainly pick up again, though development may not be as rapid as it was before.

3.5.6 Forest Development

The development of forest resources is an essential task within the overall development of the Juba Valley. Forest resources will be used not only for industrial wood production but also for satisfying the growing needs for fuel wood and rounded wood of the constantly increasing population settled in the different areas.

On the basis of the information available, the expected demand for fuel and rounded wood will be of the order of 465,000 m^3/year in 1986 and of about 1.4 million m^3/year by 2010. This corresponds to a total settled population of 650,000 by 1986 and approximately 2.2 million by year 2010 and

of per capita wood consumption coefficient of 0.7 m^3/year during the first 10-year period and 0.9 m^3/year for the subsequent years.

Forest development activities will be carried out over selected areas in the 11 irrigation districts and in the adjacent areas suitable for rounded wood production. Measures of control and improvement of the forest stock will be adopted.

Action will be developed in terms of:

- improvement of forest areas within or adjacent to the 11 irrigation districts over an area of 125,000 ha;
- creation and management of forest reserves in Baardheere and Saakow reservoir basins;
- creation of 6,000 ha of windbreaking belts at the borders of the irrigation districts;
- creation of 10,000 ha of shelter belts around expected settlement areas;
- creation of 50-60,000 ha of shrubland controlled areas in the region of Angel-Codcod, Umboi, Jilib and Faanoole;
- studies, experimentations and trials for both the selection of species suitable for irrigated forests and for the substitution of rounded wood for domestic use;
- creation of 6,000 ha of irrigated forests in the districts of Jamaame and Baardheere-Ionte and development of 10-14,000 ha of irrigated forest in marginal areas close to the irrigation districts.

The expected production from the development outlined above would be as follows:

	Rounded and fuel wood m^3/year
- from natural and improved forests	1,000,000
- from shelter belts	250,000
- from controlled areas	250,000
- from forest reserves	250,000
- from irrigated plantations (partial production) 15,000 ha	250,000

so that a total of about 2,000,000 m^3/year will be assured by year 2010.

3.6 INFRASTRUCTURES

3.6.1 General

The infrastructural items have been defined first on the basis of their instrumental function with regard to productive measures, after which they have been checked - and supplemented where necessary - on the basis of the criteria adopted for reaching a regional development scheme.

It was not thought that any useful purpose would be served by first defining the role to be assigned to the infrastructure to enable the resources to be developed, because these resources are limited and have very high absolute value. The overview of the measures in the productive and infrastructural sectors is given by the picture of the region developed. What we have particularly tried to do is to define the measures required in the communications sector, as these are of such paramount importance. The infrastructure for water use is considered as the pivot of the whole study and is dealt with in another part of the Report. In the case of the social infrastructure, certain hypotheses have been framed, which need to be worked up into projects.

3.6.2 Regional Structure

Precise constraints affecting use of the region stem from the definition of available resources, their location and the schemes for exploiting them. Other constraints derive from the development of policy goals. The preparation of a physical country planning for the Juba Region does not fall within the terms of reference of this study. None the less, we have tried to sketch in a regional structure which satisfies the constraints dictated by the implementation of the proposed investment plan and which will, at the same time, ensure a new a more effective regional balance. It is felt necessary to respect two conditions.

The first condition is that the complementary position of urban settlement and rural development of primary sector must be assured. To allow the passage from traditional society to a modern state structure and from a subsistance to a market economy it is necessary on the one hand to provide for as many changes as possible of man and society and State and on the other hand to afford a very big programme of infrastructure realization. It is therefore necessary to reach agglomeration of population operating by poles and influence areas. The second condition is the logical outcome of the basic policy goals and of the actual situation. It consists in the need to assign a specialized function to the various regions - and parts of region - of Somalia so as to renew the unity of the country through exchanges which will link the various different parts together (no lesser goad will suffice, if it is hoped to overcome the age-old isolation and self-sufficiency that affects the two traditional sectors of the economy). In other words, what must be done is to substitute the present fundamentally static regional equilibrium by a dynamic one.

These two conditions are necessary to attain social equality and to

ensure that the country's entire forces are harnessed for its development. This means that there must be a regional structure which can differentiate and maximize flows both ways, not only among the various regions but within them too and on the other hand it means to create a wide network of urban centres which live in symbiosis at their various levels of exchange and dimension.

As shown in Chapter 2, at the year of full implementation of the proposed schemes, about 58% of the population of the "economic area" of the Valley will be employed in primary sector, 8% in secondary and 34% in tertiary one. Assuming as a goal that in this year 90% of the population be settled in centres with more than 2,000 inhabitants, about 80% of the population employed in primary sector would live in urban centres. These centres would have, beyond the usual tertiary function, a function of poles for primary sector development. For the political implications of this scheme see point 1.1.1.

Country Planning of the region must be based on these schemes to define urban centres and their interrelationship.

The following points must be complied with:

- Territorial segregation of the productive sectors must be avoided; the specialized function of various areas will be reached within each productive sector.
- Population must be concentrated as far as consistant with the distances between house and workplace; services and infrastructures must be concentrated.

As irrigation schemes constitute the major part of the proposed investment projects and will in any case act as a conditioning element, the territorial structure will be constrained by their location around a narrow land strip across the river.

The result is a prevailing N-S flow with a location of the urban centres and of the convergence points of the interregional exchange flows along the axis of the Valley.

This makes more difficult and costly the observing of the mentioned conditions (a structure in which the two dimensions would be comparable would allow a decrease of average distances).

The resources known outside this narrow N-S stretch consist almost exclusively of natural pastures. Action for optimal utilization of these pastures does not add (at least at the scale of this first hypothesis) additional elements of space planning.

Urban centres with an objective vocation to become the most important ones of the "Developed Valley" are Kismayo, Dujuuma and Baardheere.

They will house services and activities at a regional scale while the other centres (for which 3 orders of magnitude could be defined in respectively 30,000, 15,000 and 3,000 inhabitants) will have mainly characteristics linked to specific schemes. Kismayo and Baardheere will have also the function of poles of exchange with the outside world. The first is already to be one of the most important centres of Somalia, with sizable infrastructure. Its function of point of convergence for external exchange flows and with Mogadishu is essential and does not need to be justified.

In the case of Baardheere, the following observations may be made:

Towns and villages have been conceived as centres to promote and not only to support development. Population should be agglomerated as far as possible in urban centres of various size (30,000-15,000-3,000 inhabitants).

Kismayo, Dujuuma and Baardheere have "regional scale" importance. Location of urban centres of smaller size is constrained by the location of irrigation schemes around a narrow land strip across the river, as these are the key element of development for the Valley.

a. It will become a pole of attraction as a result of construction of the dam. This will generate a lot of traffic in the construction stage and will create a major waterway both upstream, in the reservoir which will stretch as far as Luuq, and downstream, since the river will have a sufficiently great minimum flow. It could also become a centre for processing primary-sector products, which could benefit from the low-cost power that could be generated by the dam. The reservoir will favour also other activities such as fishing and afforestation, to be exploited commercially. Tourism will be boomed by the creation of the lake (scenically very impressive) and of the Natural Reserve.

b. It is appropriately located, from the geographical aspect, to constitute a point a confluence for traffic moving up and down the basin and across it. It can be easily linked with Mogadishu (via Dhinsoor-Baydhaba).

Dujuuma is the capital of the administrative region by the same name, recently created, and houses today the 60,000 nomads trasferred there within the framework of the drought emergency programme. For these reasons and since it is in a baricentral position in relation to very important development schemes (Saakow, Dujuuma and Afmadow) it is expected to become the second town of the Valley in terms of population weight. For the very simple fact that Dujuuma represents the first organizational model of a new economic and social structure, it will assume no doubt the role of guidance and of reference for the entire Valley.

In view of the fact that this part of the Report is pitched at the "first proposal" level, it is not possible to indicate what items of infrastructure will be needed in the proposed flow supporting points or in the minor rural centres. However, a few observations may be made:

a. The primary points must be equipped with a regional hospital, training institutes of technology, regional markets, regional collection and distribution centres, product-processing infrastructure and transport concerns; the secondary centres must have vocational schools, dispensaries, health centres, shops, markets, centres to distribute inputs for the development of agriculture and livestock, community centres, etc.

b. It is not possible to create an infrastructure and network of services over the whole area in a very short space of time, because of the high cost involved and the lack of trained staff. Priorities will thus have to be established, linked not so much to the hierarchy of nodal points as to the investment programmes in the productive sectors of the economy, the functional purpose of the various parts of the region and the volume of flows it is wished to promote in the way referred to above. Therefore, a modular approach to the infrastructural works would appear to be the best method of tackling the matter.

c. The infrastructure of the nodal points and that connecting these will have to be suitably apportioned to the whole region to stimulate compatible flows, within the general framework of the productive and functional aspects of the various parts of the region.

A global quantification of the need for the construction of services could be obtained as follows:

A. Housing

Taking an average of 20 m^3/inhabitant the need for housing of the population residing in urban centres (for more than 2,000 inhabitants) at the year 2010 would amount to 40 million m^3, corresponding to a total investment of the order of 15 billion So.Sh.

B. Services

Schools, health, religious, administrative and commercial services on the basis of 9 m^3/inhabitant which would amount to 20 million m^3 with an investment of about 7 billion So.Sh.

C. Water supply, sewerage, electricity

Water requirements for urban centres can be valued at year 2010 at about 100 l/inhabitants/day corresponding to 200,000 m^3/day.

For sewerages, 80% of the preceding value, corresponding to 160,000 m^3/day can be assumed.

Electric energy requirements could be, on the basis of 30 Watt per inhabitant, of about 60,000 kW of installed power.

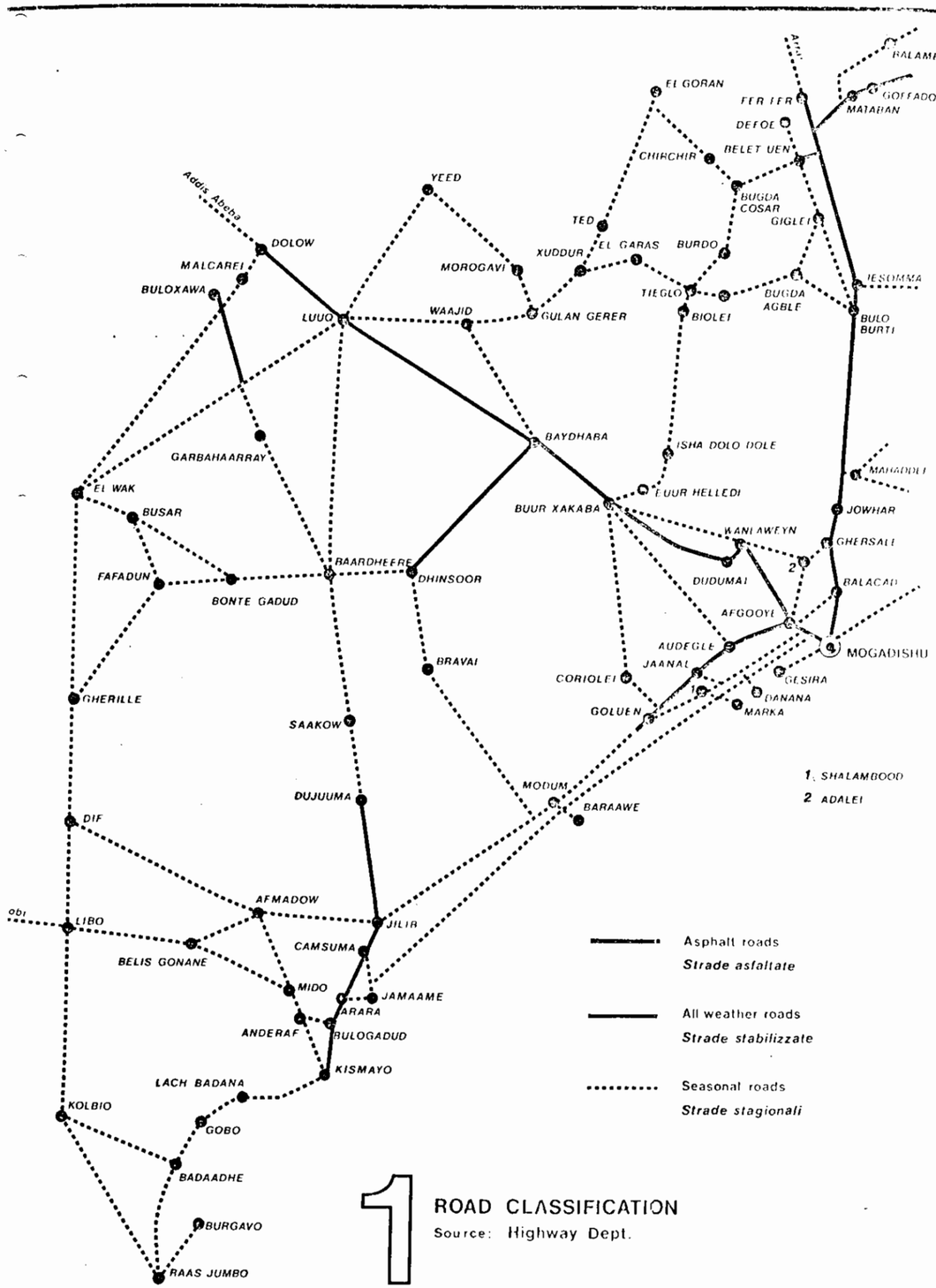
3.6.3 Transport

In the proposed communications scheme, Kismayo and Mogadishu are the points where flows come in from abroad and from whence other flows leave the country, while Baardheere and Baydhaba are nodal points for flows to and from the three northern Regions of Bay, Bakool and Gedo. The flows between the Juba area and the rest of Somalia will go through the ports of Kismayo and Mogadishu, in the case of sea transport, through Mogadishu, where overland transport is concerned, and to a lesser extent by air through the airports of Kismayo and Mogadishu. Provision should be made for a small airport at Baardheere in the year 1985 with a 6,000 feet runway to be brought to 10,000 feet in 1995.

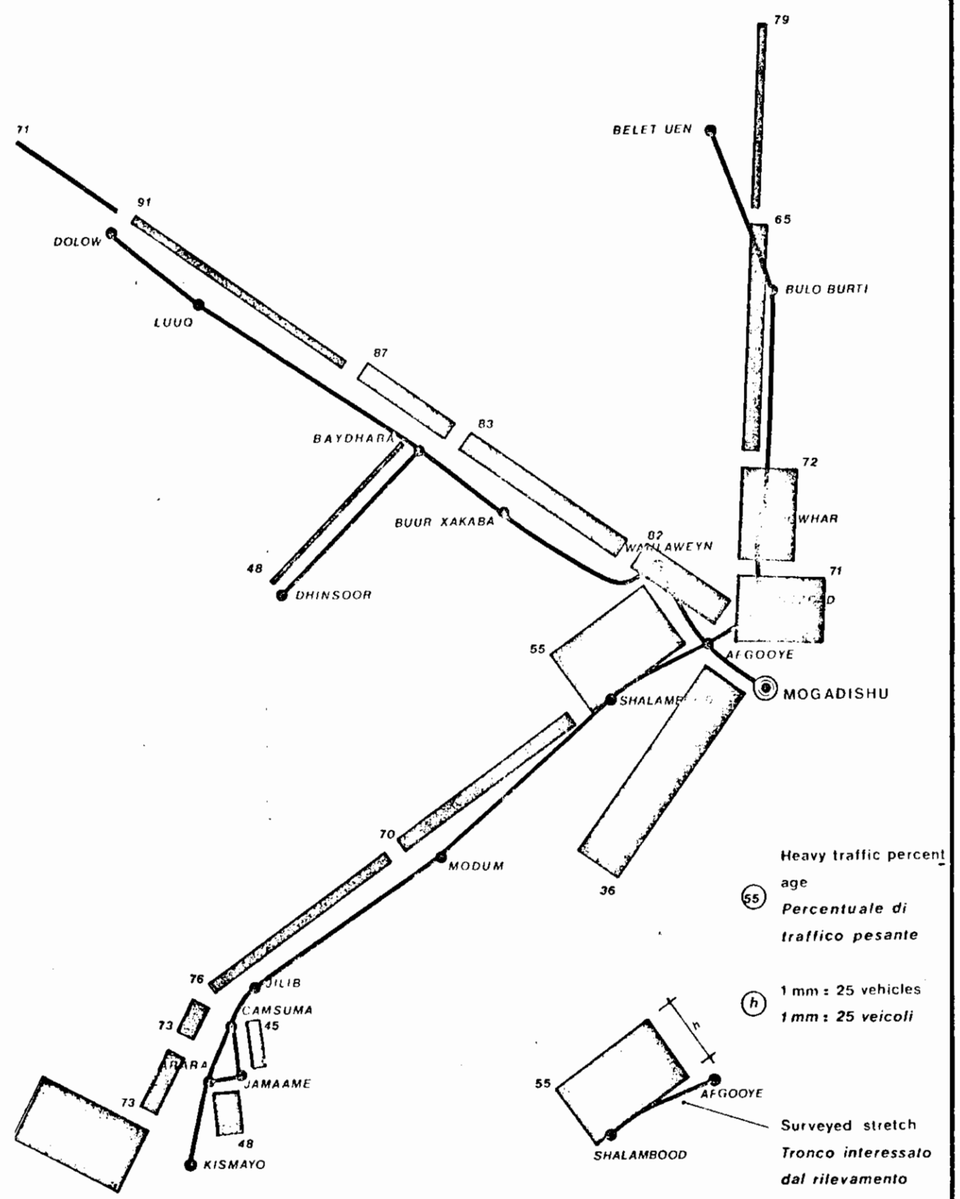
Kismayo airport was built only recently and it should be sufficient to cope with traffic until 1985, after minor improvements, up to 1995.

There will be a big increase in traffic through the port. Considering that 30% of agricultural production from the Juba development projects would go through the port of Kismayo, the 1985 export figure would be 270,000 tons (700,000 tons in 1995) against 110,000 tons of imports and exports at the moment. Capacity would seem to be adequate up to 1985, when lifting gear, ware-houses, cold stores and compounds for cattle on the hoof would be needed. An increase in capacity after 1985 would probably be required.

On an interregional scale, overland links all have to pass through Mogadishu owing to the lack of alternative channels of communication. The Five-Year Development Plan provides for completion of the Mogadishu-Belet Uen-Galcao-Bosaso road and also of the Jilib-Modun road. These two roads,



1 ROAD CLASSIFICATION
Source: Highway Dept.



2 TRAFFIC FLOWS
Technital surveyed network
1975 estimate

TECHNITAL SpA

ROAD CLASSIFICATION - TRAFFIC FLOWS
CLASSIFICAZIONE STRADE - FLUSSI TRAFFICO

fig. 10

together with the Baydhaba-Mogadishu road will aggravate this concentration on Mogadishu. However, the situation could be corrected by a road connecting Baydhaba directly to Belet Uen. This would offer the following advantages:

a. It would complete a main trunk link between Baardheere, Baydhaba, Belet Uen, Calcaio and Bosaso, without passing through Mogadishu, thus helping regional balance. Part of the traffic between the Juba region and the rest of Somalia would be diverted to this route, causing differentiation of the areas traversed and better organization of trade.

b. Between Baardheere and Belet Uen (for the Baardheere-Dhinsoor stretch, see below, while the Dhinsoor-Baydhaba section already exists) it could traverse the whole northern part of the region between the Juba and Shebeli, facilitating development and integration of these areas along with the southern part, with its larger proportion of fertile soils. The feasibility and the advantages of this link should be studied within the general framework of investments for the development of the Juba and Shebeli Valleys and of the area between the two rivers.

On a regional scale, it is necessary to build a network linking the first, second, third and fourth order centres to each other and to their hinterland. This however, cannot be done simultaneously in every area and an order of priorities must be decided.

Regional planning hypotheses indicate the following needs for different types of links:

- Primary links (between centres of regional importance)

Baardheere-Kismayo; Baardheere-Baydhaba; Baydhaba-Mogadishu; Kismayo-Mogadishu.

- Secondary links (integrating the preceding links along the identified development axis and linking urban centres of the second order of magnitude)

Baydhaba-Luuq-Dolow; Luuq-Baardheere; Kismayo-Afmadow; Afmadow-Faanoole.

- Links of the third and fourth order (they complete the network of internal links within the schemes to be studied together with regional planning) (see Table 11).

- Feeder roads (linking the most remote centres to the identified development axes and thus permitting the integration of the limited resources located around these centres)

Dolow-Buloxawa-Ceel Waaq; Ceel Waaq-Garbahaaray; Yeed-Luuq; Xudur-Baydhaba; Xudur-Uegit-Luuq; Badhaadhe-Kismayo; Dif-Afmadow.

The global needs in terms of links of the third and fourth order have been very preliminarily estimated by taking into account location and boundaries of the schemes and guesstimate about the population which will reside in the areas during the full development period.

The results are summarized in the following Table 11.

Table 11 - Global needs for the links of the third and fourth order

Scheme	Third order links km	Fourth order links km
Luuq	20	80
Baardheere	130	160
Saakow	80	100
Dujuuma	30	50
Afmadow	30	70
Faanoole - Jilib	50	60
Jamaame	40	70
Baardheere - Ionte	40	60
State Farms	10	30
Descek Uamo	40	60
Toutà	30	60
Total	500	800

For further informations on the typology and the first traffic appraisal of the most important links see Vol. V, Part I, para 3.1, 3.2.

In Table 12 an orientative programme is given for the construction of the various roads of the first and second order proposed for the first decade of the lifetime of the project.

Table 12 - Road construction ten-year programme

	Link	km	Years 1	2	3	4	5	6	7	8	9	10
Primary links	1. Baardheere-Kismayo	-										
	Baardheere-Saakow	85				(70)					25	
	Saakow-Faanoole	120		(120)								
	Faanoole-Jilib	35				35						
	Jilib-Kismayo	120								(36)		
	2. Baydhaba-Dhinsoor	120			(36)							
	3. Dhinsoor-Baardheere	80		56			(32)					
Secondary links	4. Dolow-Luuq-Baydhaba	230		(40)				(20)				
	5. Luuq-Garbahaaray	70									(45)	
	6. Garbahaaray-Baardh.	120			(65)							
	7. Kismayo-Afmadow	115					(90)					
Tertiary links	District No 9	40		20								
	" " 3	80					40					
	" " 1	20		5								
	" " 8	40							20			
	" " 4	20									10	
Quat-ernary links	District No 9	70						20				
	" " 3	100							30			
	" " 1	60				15						
	" " 8	60								10		

Note:

a. with a dashed line are indicated the extraordinary maintenance interventions.

b. the numbers between brackets indicate the investment costs in million of So.Sh.

NOTE:

The following analysis reflects the Consultants' views. An integrated Plan for wildlife resources management and for touristic development is in preparation by the Government.

3.7 WILDLIFE PROTECTION

3.7.1 The Problem of the Wildlife Environment

In addition to the National Park envisaged for the Bushbush region on which work must be started immediately, there are many reasons which counsel the creation of a Nature Reserve, in the form of a National Park on the Juba. This is the only way of preserving the existing herds of elephant, buffalo and antelope of various kinds (Balanka, Aucen, etc.), as well as the crocodiles.

The protection of wildlife is essential because its animals constitute a unique educational and tourist asset: it is now generally accepted that every country must preserve a sufficient number of typical ecosystems. These are essential for its cultural development. It is only in such areas that the community at large can come to appreciate the environmental background of its unique cultural heritage. Moreover it is essential that the people should be educated to respect nature and wildlife in the broadest sense.

A Reserve is also justified from the purely scientific aspect. Somalia's fauna and flora are decidedly unique, and the protection of this heritage will certainly benefit the whole of mankind. As indicated elsewhere (Vol. V, Part I, Chapter 5), there is no way of providing this protection without setting aside a sufficiently large area where wildlife is free to develop without fear of man. A Park can count on economic aid from various international bodies (1), that is why it is recommended that a small amount of arable land be sacrificed to create such an amenity.

There may be those who consider that concern with ecology is too idealistic and that it has little bearing on the harsh human realities of hunger and underdevelopment, but it can readily be proved that, in the long term, investment in a Park or a Reserve is a decidedly viable proposition.

3.7.2 Species to be Saved

Though the wildlife in the gallery forest along the Juba has been reduced enormously in recent years, it is still amongst the richest and most typical of that found anywhere in the world. Much less well known is the equally interesting flora.

The list of mammals is as follows: rhinoceros (Uhil) existed at least up to 1955 between the Descek Uamo and the Juba, but nothing has been reported recently in the literature; Burchell's zebra (Damar Feru) was fairly common up to 1935 and there may still be a few still around; giraffe (Gheri) are very rare; gerenuk (Elo Gedud) and Grant's gazelle (Hidi) are very rare; there is the small African antelope of Guenter and that of Kirk (Sagar Guslei),

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(1) UNEP, FAO, World Wildlife Fund

while Citerni's dikdik (Guyo) is unique; the grey duiker (Furuk) and the red duiker (Sagar gedud), which is the rarest in Somalia, and belongs to the form Cephalopus Harveyi Bottegoi, found only in the gallery forest north of Jilib; the Kudu (Der-dir); the bushbock (Dol), which is the largest bushbock in Africa; the oryx (Beit), which certainly exist in the bush on the western fringe of the Juba gallery forest, were once common and extended farther west; the topi (Sig, Aucen) which are very local in the Republic had decreased markedly by 1965, when they were found only in a few areas on the western bank of the Juba and in some parts near Avai; the Hunter's hartebeest (Irole) is a large antelope unique to Somalia and the Tana area of Kenya, and was once generally found in the Afmadow-Belcogani area and farther south, occasionally as far as the Bushbush Reserve, but can also be seen sometimes near the western edge of the forest fringing the Juba; the waterbuck (Balanka) Buffalo (Low Gessi) is again very local and the Juba Forests from Mansur northwards are among the few localities where it occours; there are also hippopotamus (Ger), warthog (Donfar) and bushpig (Genzil, Gomme), as well as elephant (Morodi), lion (Libah) and leopard (Shebel), these being seen only rarely, at least in 1965; other animals include the serval cat (Muk Shebel), the Caracal lynx (Gududanch) and the wild cat (Mukilel Dur); various kinds of mangoosen and genet cats (Dib Medu, Songur, Corshir, Daba ad, Zivet, Mululel zebat) occur, as does the spotted hyaena (Waraba, Duruah), the grey jackal (Daua) and the black-backed jackal (Dua dulmedow); the lesser bushbaby (Getriss); the greater bushbaby (Gumbo) only in the Juba fringing forest; green ververt (Corò), the whitethroated guenon (Coro medaw); and many species of rodent. It is probable that aardwark (Unfo) occur too.

It is apparent from this list that the fauna of the gallery forest are very important and varied. It will be necessary to consider what the effect of agricultural development will be on fauna in the Juba basin, especially on game animals and crocodiles, which are very important from the economic and tourism aspects.

There should be at least five kilometres between the human settlements and the game reserves, the area being controlled.

Two general principles should be accepted for any development scheme in the Juba area: 1) It is worthwhile preserving fairly vast stretches of territory purely for wildlife; 2) the development schemes must keep pace with scientific evaluation of the ecological situations, balance and possible evolution of the area; they could first be concentrated on the fringe areas and extended only gradually.

3.7.3. Definition of a Reserve

There are many rigid constraints to be observed when setting up a Nature Reserve, dictated by the need to offer living space to a sufficient number of animals to ensure survival of each species. Genetic laws indicate that a minimum of 200 large mammals is required, while smaller animals call for a higher minimum because of their high juvenile mortality. The minimum space is dictated by that of the most demanding species, in our case the elephant, with a minimum population of 200. This space is sufficient for all the other species.

During dry seasons the elephants depend exclusively on the fringing forest for food and shelter. As these animals never wade the river except in very rare cases of estreme lows, the minimum space must be ensured either all on one side or on both sides of the river. Considering the potential biomass of the fringing forest, this would mean leaving thirty or so kilometres aside as a Nature Reserve along the river, plus the adjacent areas of bush and savannah.

Regarding the criteria for siting the Reserve, it is clear that:

a. It must be in an area that is not affected by development schemes, or at least to but a minor extent;
b. it must be sparsely inhabited; if numbers are small the people will not have to be moved, but can be employed in the Reserve as scouts, to open up tracks, etc.;
c. there must be little cultivation, to avoid contact with animals and their raids on farms.

3.7.4 Area Selected

A mere thirty years back it would have been possible to create an extraordinary Reserve between the Descek Uamo and the river, but now the environment appears to be irremediably affected by human settlements.

The area to the south of Jilib must be completely excluded because of the high population and the destruction of much of the original fringing forest.

It does not seem that the area to the north of Dujuuma can be recommended either because of the great number of agricultural settlements envisaged and the interest in creating irrigation districts here.

The area north of Baardheere and around Luuq is interesting because it is so sparsely peopled and because of the non-agricultural nature of the soils. But the ecological changes introduced by a large man-made lake upstream of Baardheere will perhaps impoverish the environmental and food resources available to wildlife for several years to come. However, this area must be kept free of development because of its great interest from the tourism aspect, as already indicated, and because of the possibility of creating one or more Parks in the not-too-distant future of great interest as tourist amenities, though their interest as regards wildlife is to be determined.

Thus there remains the area to the north of Saakow and that between Dujuuma and Faanoole. The former is of no interest from the agricultural aspect, but it does not have much gallery forest. Again, as there will be a man-made lake at Saakow in the future, there is also the drawback mentioned in the case of Baardheere, plus the same tourist advantages.

The area between Dujuuma and Faanoole is thus the one best indicated for the creation of a Reserve. Considering the small size and excessive fragmentation of a possible irrigation district here, and the fact that irrigation will only be feasible by pumping, we consider that the area could better be used as a Nature Reserve, especially in view of its singular ecological advantages too. Taking a strip about 30 km long would only mean sacrificing a total of about 5,000 ha of irrigable land, because the belt of good agricultural soils is so narrow here.

To the north the area could join up with the Saakow lake region via a broad strip of land on the right bank far from the river, of no economic interest, thus permitting the lake to be included in the confines of the Reserve.

It is thus recommended that a large area be protected, taking in two stretches on the left of the river to the north of Saakow and of Kaitoi, plus the strip on the right (generally far from the banks). In course of time the Park proper could be defined within the 3,000 km^2 area scheduled for protection.

The area suggested has natural connections. Therefore the strip in contact with the agricultural areas to the north and south can be planned so as to be limited to about 5 km on each bank. This is certainly the shortest and most favourable possible along the whole length of the river. It also has a very small population.

A special aspect of this area which, among other things, calls for proper consideration, is that it can boast the biggest strip of sandy banks of anywhere on the river, as can be seen from the air photos: a necessary condition for crocodiles to breed. So the area would also appear to be one of the best for ensuring the protection of this species too. It has been shown that in order to keep African rivers adequately stocked with fish, the crocodile population must be kept high too. These reptiles are a major factor in maintaining the balance of the fluvial ecosystem, hence conservation of their main breeding grounds must be considered of prime importance.

Now, as the area discussed here stretches between areas of greatest agricultural development, it is ideally situated to act as a source from which crocodiles can spread to nearby areas to act as biological scavengers and to provide a valuable raw material (crocodile skins command high prices on world markets).

3.7.5 Action Proposed

1. The area from Kaitoi to about 20 km south of Dujuuma should be temporarily planned as a Nature Reserve on both banks of the river (on the eastern side it could run to the Dujuuma-Jilib road, and to the west to a distance of around 40-50 km from the river). This approach should be considered as a stop-grap until a more detailed plan can be evolved, and the area itself should take last place in the priorities of the development plans. It is certainly not reasonable to attempt the development of different areas at the same time and the one chosen appears to be of least significance from the economic standpoint. Thus the postponement of any possible agricultural development here will be of little importance.

2. A complete survey should be made by experts without delay. Indeed, this Report is based on preliminary information and it may well be that developments have changed a situation about which, in any case, too little was known for detailed design.

3. It is essential to make a census of the fauna and flora of all the development areas. This should be as complete as possible and should be performed before any development plan is implemented. The Government is recom-

mended to have a complete biological survey made of these areas by competent biologists who will collect all species for future reference, so that the impact of development on the biological equilibrium of these areas can be assessed.

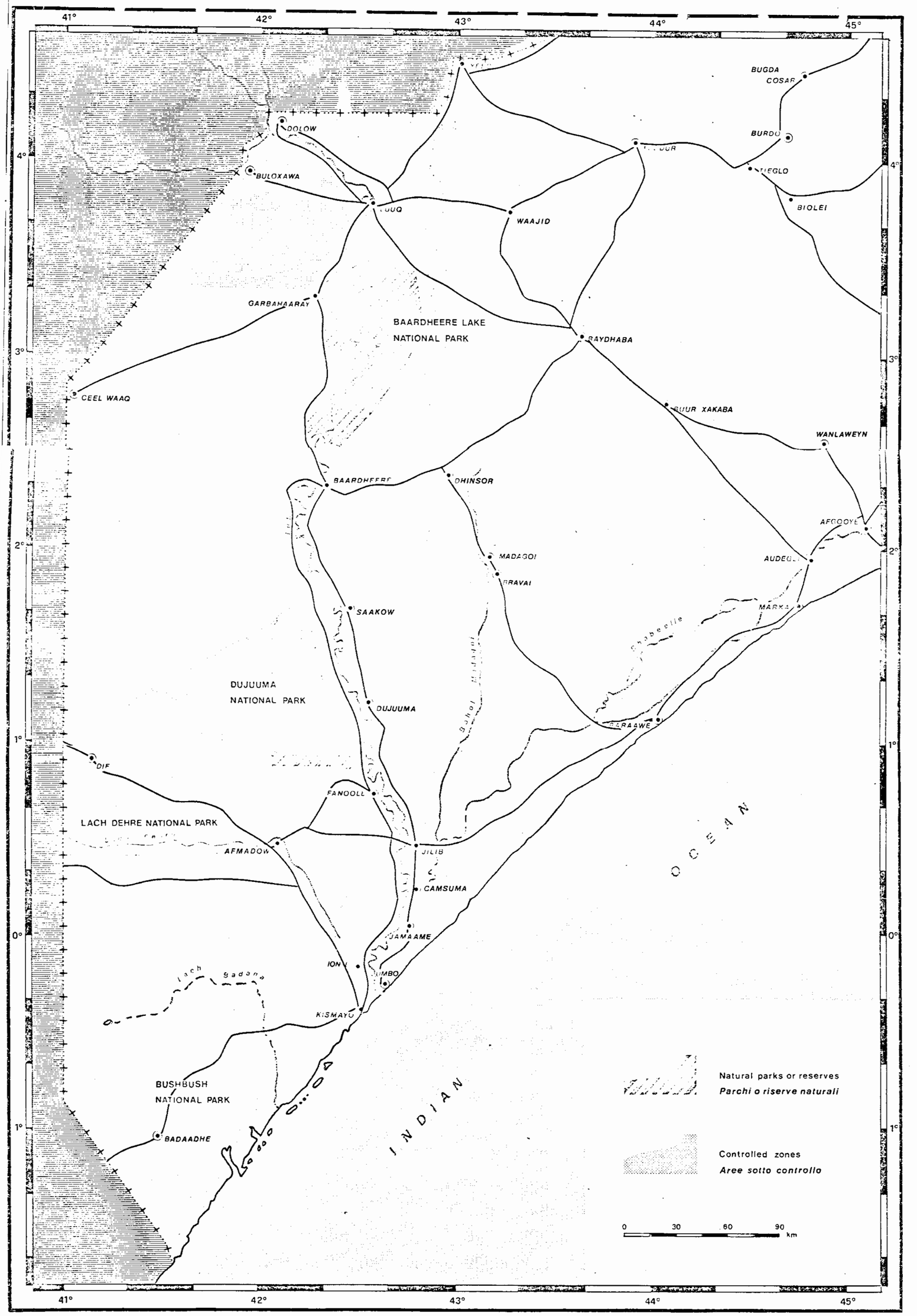


fig. 11

WILDERNESS PRESERVATION PLAN

DIFESA DELL' AMBIENTE NATURALE

CHAPTER 4.

THE DEVELOPMENT PLAN OF THE VALLEY

4.1 OVERALL OUTLINE OF MEASURES

4.1.1 Possible Frame of Reference

Any programme for the development of the Juba Valley entails control of floods and regulation of flows as an immediate step. Indeed, it is considered that the development programme cannot be implemented unless it is possible to guarantee the following points:

a. Certainty of being able to obtain regular harvests from the 220,000 ha of land (approximately) to be farmed downstream of Baardheere, and more specifically the possibility of growing multi-annual crops, essential for the trade balance, on about 43,000 ha.

b. Safety of the infrastructure and the fixed social capital assets which will be created in the region.

c. The orderly pursuit of productive and social life, by the people concerned.

It is thus considered that the control and regulation works envisaged for Saakow and Baardheere are strategic items in the development of the Valley's resources. The decision to proceed with their construction must be taken without delay, once their technical feasibility has been confirmed.

The programme here indicated concerns exclusively the irrigation schemes since action in other sectors will be conditioned by them. To establish the degree of priority to be assigned to the irrigation schemes five priority indicators have been defined: 1) specific value of the scheme; 2) population; 3) infrastructure; 4) bydraulic works; 5) location.

Each of these indicators depends upon a series of variables which take into account plan and resource objectives and real constraints.

a. Specific value of the scheme: it is directly proportionate to returns on investments necessary, to the labour density, to the specific contribution to the goal of self-sufficiency and of exports, to the specific contribution to industrialization and it is inversely proportionate to the complexity of the scheme.

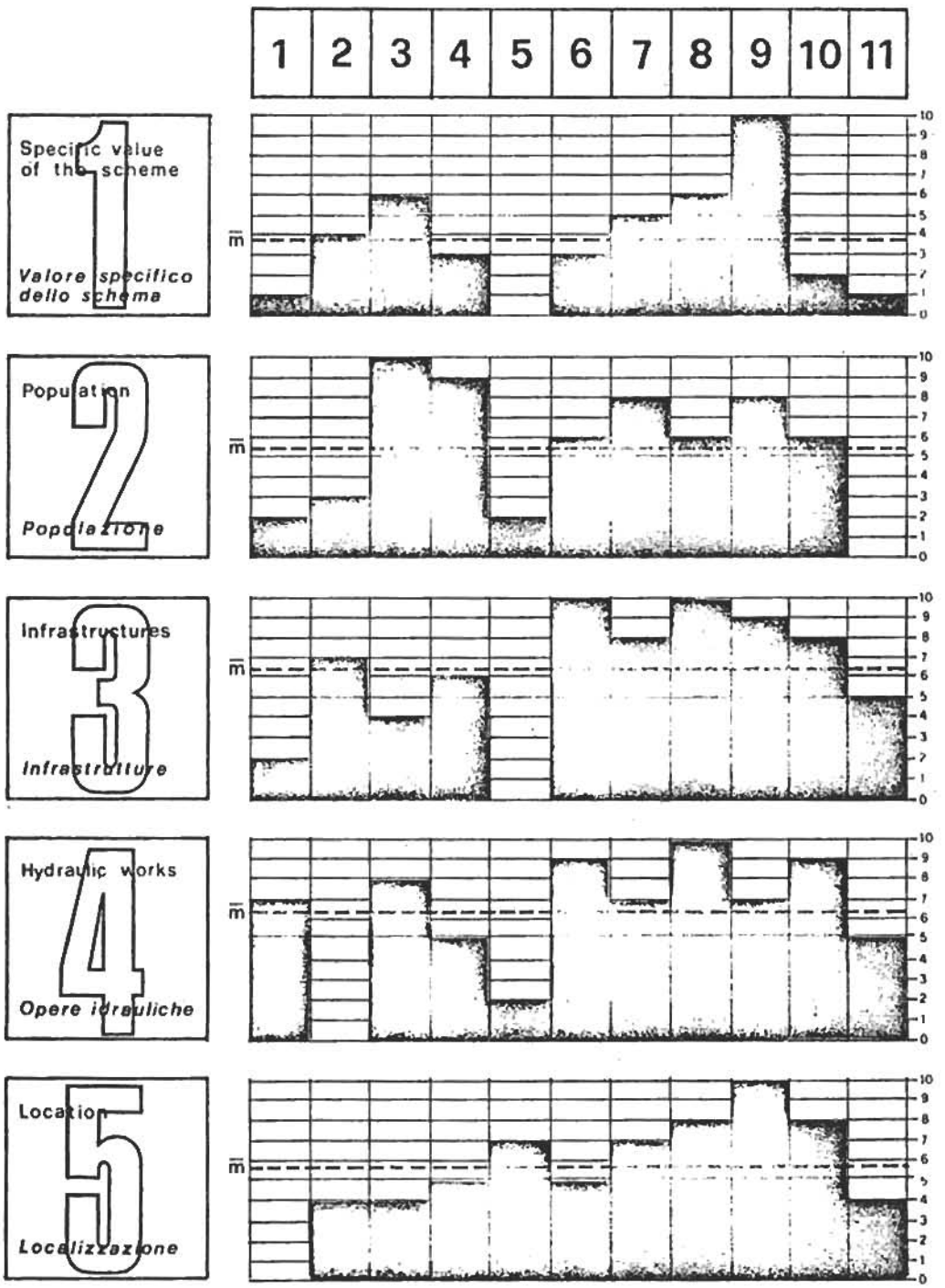
b. Population indicator: it depends on the presence of indigenous population in the area of the scheme, on the presence of population trasferred to the scheme within the framework of the emergency programme, on the propensity of population to be co-opted in the realization of the schemes and "socialized", on the demographic pressure which will follow the development of the scheme.

c. Infrastructure indicator: it depends on the existence of infrastructure for the scheme and it is inversely proportionate to the cost and the complexity of necessary infrastructure.

d. Indicator of hydraulic works (defence works and distribution network necessary to each scheme): it depends on the existence of hydraulic works and on the difficulty and cost of implementation of the necessary works.

To establish the degree of priority to be assigned to the irrigation schemes five priority indicators have been defined: specific value of the scheme, population, infrastructure, hydraulic works, location.

A value has been calculated for each indicator ranging from 0 to 10 for each scheme. To the first two indicators it has been assigned a decisive importance while the last three have been used to adjust the ranking.



VALUE OF PRIORITY INDICATORS
VALORE DEGLI INDICI DI PRIORITA

fig. 12

e. Location indicator: privileges those schemes which contribute mainly to the bettering of the regional situation, those which lay in areas where other resources are located and which are therefore integrated with other productive investments and lastly depends on the environmental and climatic conditions of the area.

The function which links each indicator to independent variables is of empirical nature: in our case it was deemed to establish a link of direct and inverse proportionality without the application of corrective coefficients which would have been anyway arbitrary. On the basis of these elaborations a value has been established for each indicator ranging from 1 to 10 for each scheme. These values are indicated in Table 13.

The values of each indicator have also been plotted in diagrams (see figure): for each indicator an average (IWT of indexes) has been calculated. It has also been decided to denominate the schemes with the median position in the scale or with the average of indexes following the configuration of the diagram (1).

To the first two indicators it has been assigned a decisive importance while the last three have been used to adjust the ranking.

Non priority schemes according to the first two indicators are considered the last ones, the priority ones in the first position and the others take intermediate places.

Table 13 - Value of priority indexes

Indicator	Scheme										
	1	2	3	4	5	6	7	8	9	10	11
1. Specific value of the scheme	1	4	6	3	0	3	5	6	10	2	1
2. Population	2	3	10	9	2	6	8	6	8	6	0
Total 1 + 2	3	7	16	12	2	9	13	12	18	8	1
3. Infrastructures	2	7	4	6	0	10	8	10	9	8	5
4. Hydraulic works	7	0	8	5	2	9	7	10	7	9	5
5. Location	0	4	4	5	7	5	7	8	10	8	4
Total 3 + 4 + 5	9	11	16	16	9	24	22	28	26	25	14
Total	12	18	32	28	11	34	35	40	44	33	15

(1) IWT represents the Index of Weighed Trend and corresponds to the difference between the average of indexes and the median of the scale.

The resulting order of priority is the following:

9	3	8	7	With priority
10	4	6	2	Intermediate
11	1	5		Without priority

4.1.2 Analysis of the Implementation Programme

The implementation programme has been defined by placing over the time horizon individual implementation programmes related to each scheme; these have been defined on the basis of cultivation techniques and of organizational characteristics (see Vol. IV, Part III) and have been considered here as unsplittable units.

The constraints of the pace of expansion of irrigated areas have been fixed for the State Farms in an average of 4,500 ha/year during the first decade (45,000 ha to be developed in total) and 8,500 during the second decade. The areas related to Family Farms have been included in the programme as independent elements. The programme is indicated in Table 14.

The above indicated rate of expansion lies between the medium and high hypotheses indicated in the first phase report (1).

If compared with the situation in other countries, the assumed pace of development would appear rather sustained and will be reached only with an enormous effort of mobilization on the part of the Government.

The programme indicated has however the scope to give a frame of reference for the decision which the Government will be called upon to take with respect to the global developmental strategy.

4.1.3 Results of the Program Implementation During the Intermediate Years

The sequence of events for the agricultural development of the Valley, indicated in Table 14 allows to build some preliminary estimates of the results which can be obtained during intermediate years of the programme.

1986 (corresponding to the 10th year of the programme) and 1996 (corresponding to the 20th year of the programme) have been taken as years of reference.

On the basis of the analysis of individual schemes, as spelt out in Vol. V, Part III, in the hypothesis that the programme will be implemented according to the expected timing, the following goals could be reached at the above-mentioned years:

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(1) The medium hypothesis assumed the development of about 38,000 ha at the end of the first decade and 118,000 ha at the end of the second decade, while the high hypothesis included respectively 82,000 ha and 207,000 ha, relying for the implementation on specialized enterprises well equipped and operating with turn-key type of contracts.

Gross agricultural product of the Juba Valley in 1986 and 1996
(Values in million So.Sh.)

		1986	1996
Gross product		550	1,500
of which:	Banana	155	315
	Sugar	145	270
	Rice	120	330

In 1986 gross agricultural product (1) would be of the order of 545 million So.Sh. made up mainly of bananas for 155 million So.Sh., sugar for 145 million So.Sh. and rice for 120 million So.Sh. The units to be employed would be about 50,000. These production results would represent an achievement in 1986 of about 26% of the final production objective, which is expected to reach 2.1 billion So.Sh. per year at project's cruising speed. As far as individual products are concerned, they would correspond to an average of the individual final production objectives of 48% for bananas, of 35% for sugar and 30% for rice.

In 1996, gross agricultural product (1) would have reached the level of 1.46 billion So.Sh., corresponding to about 70% of the gross product at project's cruising speed. At this date, for banana, sugar and rice, the following level would be achieved:

- Banana 315 million So.Sh. equivalent to 97% of final objective.
- Sugar 270 million So.Sh. equivalent to 66% of final objective.
- Rice 330 million So.Sh. equivalent to 85% of final objective.

The expected labour requirements in 1996 would be of the order of 150,000 units.

Investments and management cumulative costs have been estimated for 1986 and 1996 respectively at 2.33 billion So.Sh. and 9.63 billion So.Sh. These costs include initial investments in infrastructure and land reclamation works in the different schemes as well as all other costs related to the management and operation of production in the interested schemes.

The breakdown of the implementation programme indicate in Table 14 can give useful indications for planning. It has been deemed necessary to explore the situation which would emerge in 1986 - corresponding to the 10th year of the programme - to assess in more detail what will be presumably the impact of the programme on domestic and foreign demand of the agricultural products of the Juba Valley.

Table 15 indicates the different quantities of agricultural products which can be produced within 1986.

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(1) Livestock products excluded (20,000 tons and 30,000 tons of standard carcass weight of meat, respectively in 1986 and 1996).

Table 14 - Programme of implementation of interventions (ha/year)

	Scheme		Net surface	YEAR 1	2	3	4	5	6	7	8	9	10	11	12	13
9	Jamaame	SF	16,525	2225	3350	3350	1700	1650	1650	400	400	400	400	200	200	200
3	Saakow	SF	23,500				1500	2000	2500	2500	2500	2500	2500	2500	2500	2500
		FF	3,100	600	600	600	1300									
8	Baardheere-Ionte	SF	29,475							1565	3190	3690	4190	4190	4150	2900
7	Touta Island	SF	13,300												1350	1850
10	State farms	SF	10,300													2100
4	Dujuuma	FF	11,100											1200	1500	1800
6	Faanoole-Jilib	SF	24,600													
		FF	1,800													
2	Baardheere-Saakow	SF	44,150													
		FF	3,200													
11	Descek Uamo	SF	10,000													
1	Luuq - Dolow	SF	11,400													
		FF	5,000		500	500	500	500	500	500	500	500	500	500		
5	Dufalach-Afmadow	SF	7,800													
	Annual total	SF	191,050	2225	3350	3350	3200	3650	4150	4465	6090	6590	7090	6890	8200	9550
	Annual total	FF	24,200	600	1100	1100	1800	500	500	500	500	500	500	1700	1500	1800
	Global annual total		215,250	2825	4450	4450	5000	4150	4650	4965	6590	7090	7590	8590	9700	11350

Hydraulic constraints

End of construction of Saakow dam (January 1978)

Beginning of operating of Baardheere dam

Table 14 (Cont.d) - Programme of implementation of interventions (ha/year)

	Scheme	YEAR 14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
9	Jamaame	200	200															
3	Saakow																	
8	Baardheere-Ionte	2900	2300	400														
7	Touta Island	2350	2850	2200	1900	200	200	200	200									
10	State farms	2100	2050	2050	2000													
4	Dujuuma	2100	2400	2100														
6	Faanoole-Jilib	1000	1500	2000	2500	4000	4100	4500	2500	2500								
								900	900									
2	Baardheere-Saakow			1125	4250	4250	4250	3250	3250	2000	2000	2500	2500	3000	3000	3000	3000	2775
							650	900	1000	650								
11	Descek Uamo						1500	3500	3500	1500								
1	Luuq - Dolow								1000	1500	2000	2000	2500	2400				
5	Dufalach-Afmadow									1500	2500	3800						
Annual total	SF	8550	8900	7775	10650	8450	10050	11450	10450	9000	6500	8300	5000	5400	3000	3000	3000	2775
Annual total	FF	2100	2400	2100			650	1800	1900	650								
Global annual total		10650	11300	9875	10650	8450	10700	13250	12350	9650	6500	8300	5000	5400	3000	3000	3000	2775

Table 15 - Levels of production to be reached in 1986 (end of year 10th) (Schemes 1 - 3 - 8 - 9) - Values in tons

Products	Scheme 9 S.F.	Scheme 3 F.F.	Scheme 3 S.F.	Scheme 8 S.F.	Scheme 1 (a)	Total
Banana	124,000	-	-	124,000	-	248,000
Fruits	4,250	-	-	4,800	-	9,050
Sugar	50,000	-	-	50,000	-	100,000
Cotton	4,320	-	-	-	-	4,320
Maize	20,690	5,030	-	42,740	4,790	73,250
Vegetables	48,400	12,960	-	25,500	10,215	97,075
Tobacco	1,990	-	-	2,200	-	4,190
Sorghum	-	2,055	-	19,715	-	21,770
Wheat	-	1,550	-	-	1,600	3,150
Oilseeds	-	2,680	-	9,875	2,190	14,745
Legumes	-	740	9,060	7,820	585	18,205
Rice	-	-	84,800	-	-	84,800
Minor fibres (b)	-	-	-	3,750	-	3,750

(a) At year 10th the following cropping pattern is considered: Maize 1,100; Wheat 900; Oil seed crops 2,000; Vegetables 250; Legumes 250.

(b) Almost exclusively jute to satisfy domestic demand for the production of bags.

In order to compare these data with total domestic demand and foreign demand at the same date, some extrapolations have been made to estimate both total population of Somalia and the level of total domestic demand for individual products.

The Somali population in 1986 can be estimated of the order of 3,960,000 units by applying an average rate of increase of 2.6% to the estimated population of 3,394,000 units in 1980. As far as per capita consumption in 1986 is concerned, the extrapolated figures adopted are indicated in the following table 16.

Table 16 - Estimated per-capita agricultural products consumption in 1986 and total domestic demand

Products	per-capita kg in 1986	Total domestic demand in 1986 (tons)
Cereals	131.9	552,320
- Wheat	9.5	37,620
- Rice	13.4	53,060
- Maize and Sorghum	109.0	431,640
Sugar	21.7	85,930
Vegetables	20.4	80,780
Fruits (excluded bananas)	9.9	39,200
Bananas	13.3	52,670
Vegetable oils	2.9	11,500
Meat (a)	30.0	119,000

(a) Expressed in equivalent standard carcass weight and excluded poultry.

Table 17 - Juba Valley contribution to meet domestic and foreign demand of agricultural products in 1986 (000 of tons)

Products	Domestic demand foreseen (A)	Potential external demand (B) *	Juba Valley production	%	
				on (A)	on (B) **
Cereals	522	-	183	35.0	-
- Wheat	38	-	3	7.9	-
- Rice	53	60	85	160.4	53.3
- Maize and sorghum	431	-	95	22.0	-
Sugar	86	60	100	116.3	23.3
Vegetables	81	-	97	119.7	-
Fruits (excluded bananas)	39	-	9	23.1	-
Bananas	53	400	248	467.9	48.7
Vegetables oils	11	25	5	45.4	-
Meat ***	119	30	20	16.8	-

* Indicative estimate

** Percentages to meet the potential foreign demand, after having met totally the domestic demand.

*** Expressed in equivalent standard carcass weight and excluded poultry.

To this amount industrial proceeding costs related to sugar cane and paddy have to be added for a total of 13.5 billion So.Sh.; thus overall costs of the schemes will add up to 55.4 billion of So.Sh. (8.8 billion US $). See Table 18.

The foreign exchange component (5.9 billion US $) represents 63% of the total cost of 11 schemes (Table 18). This weight which is no doubt very high is justified by the need of importing the major part of industrial products (gasoil, lubrificants, cement, iron, etc.) which are required for the implementation of the project and the operation of the schemes (machinery, fertilizers and pesticides).

Investments for land reclamation only will be of the order of 3.1 billion So.Sh. (490 million US $) and their breakdown between the different categories indicated in Table 19.

Table 18 - Project costs and foreign currency components during economic life of Project (50 years)

	Project cost		Foreign exchange cost	
	million So.Sh.	million US $	million US $	% on total cost
1. Land reclamation	3,095	490	245	50
2. Farm infrastructure	1,155	183	72	40
3. Materials	440	70	63	90
4. Personnel	1,985	314	-	-
5. Running costs	11,435	1,808	1,085	60
6. Costs of inputs	21,010	3,323	2,825	85
7. Contingencies (a)	2,850	450	360	80
8. Industrial processing	13,480	2,132	850	40
Total	55,450	8,770	5,500	63
Total investment costs (c) (1-3)	4,850	768	395	51
Total running costs (c) (4-6)	37,120	5,870	4,255	73

(a) 10% of costs, net of personnel costs.
(b) Processing of sugar cane and rice; handling and conditioning of bananas.
(c) Included contingencies (540 million So.Sh. equal to 85 million US $).

Potential foreign demand in 1986 has been obtained with indicative estimates which took into account the exports objectives indicated for both year 1980 and the years beyond 1990.

Table 17 gives the results of these analyses, made in the attempt to estimate the Juba Valley contribution to the Somali economy.

For some products such as sugar, banana and rice, production of Juba for 1986 will be able not only to meet entirely domestic demand but also to cover respectively 23%, 49% and 53% of potential foreign demand at the same date (1).

Conversely, in the case of cereals, which will be able to satisfy only 35% of total demand taking into account however the fact that among the cereals part of the rice produced (32,000 tons) will be used for exports. As far as the consumption of meat is concerned, the production of Juba will cover only about 17% of domestic demand (2).

As far as other products are concerned (cotton, tobacco, legumes and jute) they will be used predominantly for internal consumption even if in the case of tobacco the 4,000 tons produced may be, if so desired, exported against a potential foreign demand estimated at about 6,000 tons.

4.2 COST-BENEFIT ANALYSIS (for details and calculations cfr. Volume V, Part III)

4.2.1 Project Costs

Investment costs of the 11 irrigated schemes considered have been estimated at about 4.9 million So.Sh. equivalent to 770 million US $ (3). If operating costs are added (personnel, maintenance and production costs) total costs will add to 37 billion So.Sh., contingencies included and due account taken of the lifetime of individual schemes (50 years) (4).

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(1) It should be remembered, naturally, that at the end of the implementation programme, the situation will be partially modified with the increase of the domestic demand.

(2) It should be remembered that also the rest of Somalia will contribute to meet total domestic demand.

(3) 1 US $ = 6.3227 So.Sh.; 1 So.Sh. = 0.15816 US $

(4) All estimates are for landed costs at Kismayo or Mogadishu, depending on which port is nearest to the scheme concerned. Official wage rates have been adopted for local labour, albeit use of shadow prices could be justify, broadly estimated at between 60 and 75% of current rates, depending on qualifications.

Table 19 - Investments for land reclamation

	Distribution %	Cost per hectare (gross area) So.Sh.
Preliminary works deforestation and levelling	23.3	2,700
Farming canals network	20.8	2,410
Drainage network	17.1	1,980
Farm viability	9.3	1,080
Windscreen curtains	2.0	235
Engineering and contingencies	27.5	3,190
Total	100.0	11,595

The average cost of the land reclamation works, calculated as weighed average among the values of individual schemes ranging from 10,000 So.Sh./ha to 15,000 So.Sh./ha, is of the order of 11,600 So.Sh./ha (1).

Investments for on-farm infrastructure are about 1.2 billion So.Sh. (183 million US $) and are represented for 80% by warehouses for production means (machinery, fertilizers, etc.) and warehouses for the storage of products. The cost per ha is about 435 So.Sh. and is rather uniform for all the schemes.

Running costs at So.Sh. 11,400 million (US $ 1,800 million) account for approximately 21% of the total for the schemes, while inputs at So.Sh. 21,000 million (US $ 3,300 million) account for about 38%. These categories of costs are rather high because they are made of equipment and raw materials which have to be imported; they have therefore been valued at international prices, with all the implications that the current world situation has on the level of these prices. Hence, the high foreign exchange component (about 76%), is higher than that usually resulting in similar projects.

In order to limit the foreign exchange component, in years to come, it has been assumed that fertilizers would be imported as raw materials and their mixing and packaging would be made locally with the advantage, inter alia, of varying the composition of fertilizers according to local needs.

The relatively limited weight (5% of the total cost) assumed for the personnel is justified by the following conditions:

1. Foreign consultants have been excluded for the starting of individual schemes.

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(1) Gross area = 264,595 ha.

2. Engineering costs have been included in the land reclamation investments.

3. A co-operative type of management has been decided as far as State Farms are concerned. This form has been selected because the alternative possibility of using wage earners may have meant a less rational choice. In fact, the option which is basic in the project, of preferring, whenever possible, high labour intensity solutions, has, as a consequence, work diagrams which are rather irregular throughout the year, with very high peaks of employment during the harvest and very low points of employment needs during the other months. The adoption of fixed wage earners would therefore lead to a very high degree of underemployment even if their use for maintenance works is taken into account.

In conclusion, the average cost per ha of net cultivated area (1) during the 50 years of lifetime of the project would be of 260,000 So.Sh. (almost 40,000 US $). This will be higher in the State Farms as against Family Farms (respectively 266,000 So.Sh. and 218,000 So.Sh.), with an increase cost of about 22% (see Table 20).

Naturally, the differences are even higher when individual schemes are looked at and such differences can be attributed particularly to the presence in the State Farms of high capital intensity crops (banana, grapefruit, sugar cane). It is to be underlined that it has been possible to reduce such differences in that the scale economies will play towards a reduction of costs, mainly management costs, in the State Farms.

Furthermore, it is to be noticed that the major difference concerns the costs per ha for equipment (mainly agricultural machinery): they correspond in fact to about one half of those in the Family Farms where mechanized operations are limited to ploughing. In the State Farms, by contrast, mechanization is more generalized including plant protection by way of airplanes: this cannot be avoided not even partly because of the constraint of double cropping and the limited time available for the required air spraying for plant protection.

Units costs for personnel are higher in the Family Farms following the need to ensure a very good and well spread assistance to farmers, essential to teach them rational systems of cultivation. They are however limited to fertilization and plant protection; and the introduction of very demanding crops has been always avoided.

Lastly, the management costs, personnel included, at the project's cruising speed, has been estimated at 3,400 So.Sh./ha, with a weight on gross production of 39%. The corresponding values decrease in the Family Farms to 2,900 So.Sh. and go up in the State Farms to 3,500 So.Sh. with weights which are respectively 45% and 38% of gross production. The level of expenses for the Family Farms may be considered rather high, but it is attributable to the fact that they include expenses for personnel and management of service cooperatives for the acquisition of technical inputs and the sale of production and for technical assistance.

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(1) ha 215,250 (221,500 ha - 6,225 ha already under cultivation).

Table 20 - Investment and running costs per net cultivated hectare of Family and State Farms, and overall costs during the life of the Project (50 years)

Costs	Investment and running costs					
	Family Farms		State Farms		Overall	
	Total million So.Sh.	per ha '000 So.Sh.	Total million So.Sh.	per ha '000 So.Sh.	Total million So.Sh.	per ha '000 So.Sh.
a. Investment (1)	515	21.3	4,335	23.0	4,850	228.0
- Land reclamation	375	15.5	2,720	14.4	3,095	14.5
- Farm infrastructure	100	4,1	1,175	6.2	1,275	6.0
- Materials	40	1.7	440	2.4	480	2.3
b. Running (1)	4,750	196.3	45,850	243.4	50,600	238.0
- Personnel	281	11.6	1,700	9.0	1,981	9.3
- Operation	1,369	56.6	10,670	56.6	12,039	56.6
- Production	3,100	128.1	20,000	106.2	23,100	108.7
c. Industrial processing	-	-	13,480	71,6	13,480	63.4
Total (a + b)	5,265	217.6	50,185	266.4	55.450	260.8

(1) Including contingencies

4.2.2 Benefits

Gross incremental benefits (1) have been valued at project's cruising speed at 2.1 billion So.Sh. equivalent to 340 million US $, and set forth in the following Table 21.

Table 21 - Value of gross agricultural production at project's cruising speed

	Value of the gross agricultural production					
	Total			per ha of net cultivated area		
	million So.Sh.	million US $	%	So.Sh.	US $	index (tot = 100)
Family Farms	170.2	26.9	8.0	7,033	1,112	70.1
State Farms	1,961.9	310.3	92.0	10,404	1,645	103.8
Total	2,132.1	337.2	100.0	10,025	1,585	100.0

More than 92% of benefits derived from State Farms with a value per ha higher, on average, than 10,000 So.Sh. while it is below 7,000 So.Sh. in the Family Farms. The range however is much larger as benefits per ha go around 20,000 So.Sh. in the 8th scheme and are below 2,000 So.Sh. in the first scheme.

(1) Benefits are net of re-employment for seeds. For ADC controlled products official 1975 prices have been assumed; for bananas the prices fixex by the recent agreement between the Somali Government and EFIM; for other products, prices are cif Mogadishu.

4.2.3 Economic Justification of the Schemes

Net benefits of all the schemes at the project's cruising speed year would be of the order of one billion So.Sh. (about 160 million US $). This value has been cautiously assumed for subsequent years; in reality it is plausible that the amount of net benefits would continue to grow, at least in the subsequent decade, even without changing the assumed technological level. This assumption is justified by the fact that during the first 20 years not all the positive effects of the expected technological change would take place, especially in relation to the unavoidable slowness with which technology will be accepted and applied by the farmers.

On the basis of such considerations, the internal rates of return of the 11 schemes would range in a rather wide gamut of values going from a maximum of 19.0% to a minimum of 4%.

Schemes	Internal rates of return of: Family Farms	State Farms
1°	7.0%	4.5%
2°	13.5%	11.5%
3°	7.5%	12.2%
4°	6.0%	-
5°	-	5.0%
6°	8.1%	9.0%
7°	-	11.0%
8°	-	12.9%
9°	-	19.0%
10°	-	4.0%
11°	-	16.0%

4.2.4 Analysis of the Effects on the Balance of Payments

As it was indicated in the preceding paragraphs, the programme for agricultural development of the 11 schemes will have as a whole a total cost of 42 billion So.Sh. throughout the entire time horizon of implementation. About 49 billion So.Sh. will be investment costs and 37.1 billion So.Sh. management and operating costs of all the schemes. The foreign exchange component of total costs would be about 29.4 billion So.Sh. (2.5 billion for investments and 26.9 billion for management and operating costs).

It is appropriate now to examine in detail what will be the expected results of the programme on the balance of payments of Somalia.

Against the above-mentioned foreign exchange costs it is necessary to evaluate the positive results which will be obtained in the balance of payments.

The positive effects are of two different types:

a. increase in the value of exported goods;
b. savings in foreign exchange payments resulting from the substitution

of presently imported goods with those which will be produced in the Valley.

If the two benefit flows are analyzed separately, the following results emerge:

- the value of exports would reach about 1,275 million So.Sh. per year at project's cruising speed.
- as far as substitution of goods imported at present (practically all food products except vegetables) is concerned, the saving on foreign exchange expenses would be at that time of the order of more than 680 million So.Sh. per year.

The cumulative value of both these effects on the balance of payments would be of about 85 billion So.Sh. at current prices to be compared with the cumulative total foreign exchange costs of 29 billion So.Sh.

This comparison, however, is of limited significance, if due account is taken of the different timing at which will take place the entry and exit flows with the rest of the world.

APPENDIX

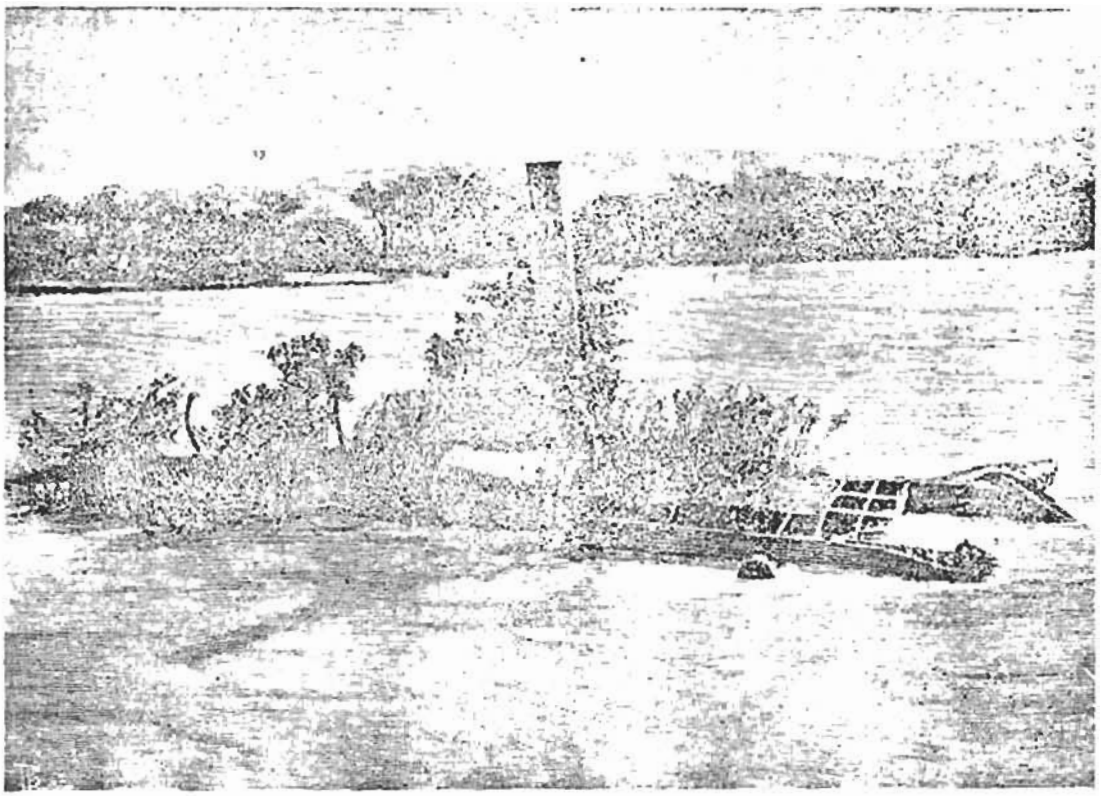
HISTORICAL NOTES

Colonial Era in Southern Somalia

1503	The Portuguese, under Tristan da Cunha, occupy Mogadishu.
1507	The Portuguese land at Baraawe and set fire to the city.
1586	Turkish conquest of Baraawe.
	Portuguese reconquest.
1650ca.	The country comes under the domination of the Sultan of Oman.
1825	The British occupy Baraawe temporarily.
1871	The Sultan of Zanzibar occupies Mogadishu.
1885	Trade treaty between A. Cecchi and the Sultan of Zanzibar.
1889	Italy signs protectorate conventions with the Sultans of Obba, Mijirtein and others. Occupation of Ataleh; Benadir Protectorate. Recognition of Italian influence down to the Juba, south of the 5th parallel.
1892	Italy leases Benadir from the Sultan of Zanzibar.
1896	Italo-Ethiopian war. Siege and defence of Luuq by Somali troops under the command of U. Ferrandi.
1905	Repurchase of Benadir (144,000 pounds). Establishment of the colony with the northwestern border at Mada Ghegno (17 Km north of Domo on the 8th parallel) and the western border on the Juba up to the 5th parallel.
1910	Occupation of Dolow.
1912-14	Occupation of the up-country part of Somalia. Recognition of the boundary with Ethiopia: Malca-Rie-Dolow-Mustahil-Wal Wal-Galladi-Domo.
1916-20	The Mullah wages war against the British.
1925	Britain cedes a section of Kenya (Trans-Juba) to Italy thus extending Somalia's boundaries to south of the Juba.
1926-27	De Vecchi's military campaign for the complete occupation of the coastal regions.
1934	The Wal-Wal incident (Ogaden): casus belli with Ethiopia.
1935-36	Italian occupation of Ethiopia and the creation of Italian East Africa. The Somali governorate, with capital in Mogadishu, includes the whole of Ogaden and the eastern part of the Borana (border along the Dawa Parma up to Tomolé and along the Ganale Doria in the stretch running west to east up to the confluence with the Webi Mana; along the Webi Shebeli - Dacata from Imei to Latitude 8°60').
1940	Italian occupation of Somaliland and reunification of the whole of Somalia.

Van der Decken's wrecked yacht as found by Bottego's expedition in 1892, Van der Decken explored the Juba from the mouth up to Baardheere in 1865 and wrecked in the Harriento rapids, right where the dam is now supposed to be built.

(From "Il Giuba esplorato" by V. Bottego, 1895)



1941	British occupation of the whole of Somalia.
1949-60	Italian trusteeship administration for the U.N. of the former Italian Somalia.
1960	Independence.
1969	National Revolution.

Geographical Exploration of Southern Somalia in the 19th Century.

Main Geographical Campaigns on the Juba in the first half of the 20th Century.

1843 Exploration of the Shebeli by W. Christopher and G. Guillain starting from Marka.

1865 Exploration of the Juba by C. Van Der Decken with the boat "Welf"; discovery of Baardheere; boat sinks at Harriento; slaughter; inhabitants abandon Baardheere.

1878-83 Georges Révoil explores Mijirtein and goes up the Shebeli.

1885 Exploration of Ogaden and the Shebeli by F. and W. James.

1891 E. Baudi explores Somaliland and Harar.

1892 Vittorio Bottego starts from Berbera and reaches Ganale Guddà via Milmil. Ganale Guddà is renamed Ganale Doria and Dawa becomes Dawa Parma; discovers Luuq with Grixoni and descends to the coast at Baraawe.

1893 Ugo Ferrandi explores and describes the Juba up to Baardheere.

1910 Pardo Diego makes a rapid survey of the Luuq-Baardheere section of the river.

1911 The Istituto Geografico Militare plots the 1:50,000 map of the region on the left bank from Jilib to the mouth of the river.

1911 Poppi-Toscano boundary Commission.

1911 A subsidised shipping company starts a river service on the Juba running regularly between Kismayo and Giumbo with occasional connections to Baardheere (29 trips to Baardheere from 1912 to 1923).

1923-24 The Duke of Abruzzi's expedition under the technical leadership of G.B. Carniglia, explores the river from Dolow to Jilib. This stretch of the river is surveyed using rangefinder and compass. Coordinates of Dolow determined by astronomical methods. River navigation system elaborated. The great possibilities of a dam upstream of Baardheere are emphasized.

1925-26 After acquisition of the Trans - Juba Region, the second Carniglia mission explores the whole of the river from Dolow to the mouth. Discharge measurements taken at Baardheere and in the southern regions. All pertinent data bearing on navigability of this inland waterway are determined. Astronomical measurements taken to fix coordinates and rapid surveys made of the course of the river. Elevations of the regions around the river deduced in relation to the elevation of the river itself.

1936 The Istituto Geografico Militare publishes a 1:1,000,000 map of Italian East Africa. Some sheets of the map show 100 m contours derived from "information" - little of which scientific - of very variable reliability.

This picture, from Bottego's book "Il Giuba esplorato" (1895), is of peculiar interest: it shows the first hydrographic sections of the river, as surveyed by the author's expedition in 1892. This expedition was of decisive importance for the exploration of the region, but also furthered the colonial penetration in Somalia. Note the names given by Bottego to the different watercourses.

(From "Il Giuba esplorato" by V. Bottego, 1895)

Il GIUBA ed i suoi AFFLUENTI

ESPLORATI

dalla SPEDIZIONE del Cap. VITTORIO BÒTTEGO

inviata dalla

SOCIETÀ GEOGRAFICA ITALIANA

Settembre 1892 - Settembre 1893

SEZIONI RETTE e VELOCITÀ

Scala Unica di 1 : 700

Componente destra dell'Auata Parma
(5 Maggio 1893 tempo di piena)
1ª grande

Componente sinistro dell'Auata Parma
(5 Maggio 1893 tempo di piena)
1ª piccola

Ponte Parma
(Addì 27 Febbraio 1893 tempo di media quantità d'acqua)
1ª piccola

Dannàba
(24 Marzo 1893 tempo di piena)
1ª media

Gelosa Doria
(23 Marzo 1893 tempo di piena)
1ª media

Lokita
(23 Marzo 1893 tempo di piena)
1ª media

Gherlèlta
(20 Marzo 1893 tempo di magra quantità d'acqua)
1ª piccola

Hababì
(18 Aprile 1893 tempo di magra quantità d'acqua)
1ª piccola

Buggiuna
(13 Aprile 1893 tempo di magra quantità d'acqua)
1ª media

Ina
(15 Aprile 1893 tempo di media quantità d'acqua)
1ª media

Biddimo
(11 Gennaio 1893 tempo di magra)
1ª piccola

Uelmàl
(a monte confluenza Biddimo
11 Gennaio 1893 tempo di magra)
1ª piccola

Ganale Diggò
(7 Gennaio 1893 tempo di magra)
1ª piccola

Dumàl
(3 Gennaio 1893 tempo di magra)
1ª piccola

Uelmàl
(11 Dicembre 1892 tempo di media quantità d'acqua)
1ª piccola

Uebi Mane
(10 Dicembre 1892 tempo di magra)
1ª piccola

Ueb Gestro
(15 Novembre 1892 tempo di media quantità d'acqua)
per 1ª P = m 0.81 P = mc 6.552

Ganana Doria
(1ª Km a valle confluenza Ueb Gestro 12 Luglio 1893 tempo di media quantità d'acqua)
per 1ª P = m 1.00 P = mc 147.650

Dawa Parma
(Dalle 12 Luglio 1893 tempo di media quantità d'acqua)
per 1ª P = m 1.10 P = mc 24.256

Ganana Doria
(Luglio 20 Luglio 1893 tempo di media quantità d'acqua)
per 1ª V = m 0.75
P = mc 49.600

Uebi Ruspoli (Ime 8 Ottobre 1892 tempo di media quantità d'acqua) per 1ª V = m 0.83
P = mc 49.600

Ganana Doria
(Bardera 25 Agosto 1893 tempo di media quantità d'acqua)
per 1ª V = m 0.69 P = mc 209.372

Uebi Ruspoli (Sobilale 6 Settembre 1893 tempo di media quantità d'acqua) per 1ª V = m 0.129
P = mc 51.178

A. Bertolini

1938 The Italian Touring Club Guide of Italian East Africa emphasizes that there are no reliable maps of the area.

The situation has changed little since then. Consequently there have been incredible delays which have hindered all design schemes, even those at the preliminary level. For many years, there has been much discussion of possible schemes, all conjectural and academic, because there were no real data, and hence there could be no systematic approach. Finally, in 1962 there was an aereophotographic survey of the area at an apparent scale of 1:60,000. Then in 1966, the Jilib-Baardheere-Isha Baydhaba-Luuq road alignment was surveyed and levelled.

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III,II,1,2	Work documents for main hydraulic projects - Baardheere Reservoir - Cross section from 1 to 59 (scale 1:5,000/500)
III,II,1,3	Work documents for main hydraulic projects - Baardheere Reservoir - Cross section from 60 to 129 (scale 1:5,000/500)
III,II,1,4	Work documents for main hydraulic projects - Baardheere Reservoir - Cross sections from 130 to 190 (scale 1:5,000/500)
III,II,1,5A	Work documents for main hydraulic projects - Saakow preliminary survey (scale 1:20,000)
III,II,1,5B	Work documents for main hydraulic projects - Saakow preliminary survey (scale 1:20,000)
III,II,1,6	Work documents for main hydraulic projects - Saakow Reservoir - Cross sections from 1 to 57 (scale 1:5,000)
III,II,1,7A	Work documents for main hydraulic projects - Baardheere preliminary survey (scale 1:60,000)
III,II,1,7B	Work documents for main hydraulic projects - Baardheere preliminary survey (scale 1:60,000)
III,II,I,8	Work documents for main hydraulic projects - Cross sections downstream to Baardheere
III,III,2,1	Irrigation Scheme (scale 1:200,000)
IV,I,2,1	Land Classification (scale 1:200,000)
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IV,II,1,1	Land Use Map (scale 1:200,000)
V,I,3,1	Main Regional Structure and Links (scale 1:200,000)

B I B L I O G R A P H Y

DEMOGRAPHY AND LABOUR FORCES

- ILO - Report to the Government of the Republic of Somalia on manpower assessment and planning, 1970.

- MINISTERO DELL'EDUCAZIONE - Education and training projects, april 1970.

- MINISTRY OF LABOUR - Quartery Labour Statistics & Bulletin, april-june 1972.

- MINISTRY OF LABOUR - The manpower implication of current development strategies, Vol. I. Manpower Project, august 1972.

- SOMALI DEMOCRATIC REPUBLIC - Report on demographic survey of Mogadishu, july 1967.

- MINISTRY OF PLANNING - Pilot survey of nomadic households in Burao District Region, february 1974.

- MINISTRY OF EDUCATION - Annual Report and statistics of education in Somalia, 1973.

- AMERICAN UNIVERSITY OF BEIRUT - Sociological evaluation of a pilot project for bedouin settlement. A case study.

- MINISTRY OF PLANNING - The Multipurpose survey of Kismayo District, march 1969.

- MINISTRY OF HEALTH AND LABOUR - Manpower survey in Kismayo, 1969.

- MINISTRY OF PLANNING - The multipurpose survey of Afmadow District, august 1969.

- MINISTRY OF PLANNING - Pilot sample survey on rural population and their livestock in Baardheere District in june 1971, june 1972.

- MINISTRY OF PLANNING - The multipurpose survey of Jilib District, april 1969.

ECONOMY AND STATISTICS

- IBRD - The Economy of the trust Territory of Somaliland, january 1967.

- MINISTERE DES AFFAIRES ETRANGERES - Rapport du Gouvernement Italien

à l'Assemblée Générale des Nations Unies sur l'Administration de tutelle de la Somalie, 1959.

- A.GRAZIOSI - L'economia somala nell'attuale processo di sviluppo, in "Il Risparmio", XV, fasc. 3, marzo 1967.

- IBRD - Current Economic Position and Prospects in Somalia, october 1967.

- MINISTRY OF FINANCE - Customs Tariff of the Somali Republic, 1969.

- CENTRAL STATISTICAL DEPARTMENT - Statistica del Commercio con l'estero; 1969, 1970, 1971, 1972.

- MINISTRY OF PLANNING - Consideration on the Foreign Trade of Somalia; february 1973.

- CENTRAL STATISTICAL DEPARTMENT - Statistical Abstract, 1967, 1968, 1969, 1970, 1971, 1972.

- CENTRAL STATISTICAL DEPARTMENT - Industrial Production 1970, 1971, 1972, 1973.

- DIRECTORATE GENERAL OF PLANNING AND COORDINATION - Revised Programme of Assistance required to the Drought stricken Areas of Somalia, january 1975.

- SOMALI NATIONAL BANK - Bulletin, may 1974.

- SOMALI NATIONAL BANK - Annual Report and Notement of accounts, 1973.

- MISSIONE INTERMINISTERIALE per lo studio dei problemi della siccità Inter-River Area Survey, february 1975.

DEVELOPMENT PROGRAMMES

- HENDRIKSON - Feasibility study on the establishment of an Agricultural Development Bank in Somalia.

- FED - Notes sur les principaux projects presentés au FED.

- HENDRIKSON - The progress of development projects in Somalia, 1965.

- CEE - Possibilità di industrializzazione degli stati africani e malgascio associati. VI, Somalia: Vol. I Rapporto, dicembre 1966.

- A.D. QURESHI - Social Planning and Development in Somalia, march 1967.

- HENDRIKSON, Investment Guide for Somalia, august 1968.

- UNIVERSITY OF WYOMING - Somali Program, 1970.

- HENDRIKSON - A macroeconomic approach to development planning in the Somali Democratic Republic, Part I: Estimate of some basic data, 1970; Part II: Investment opportunities, 1971.

- IBRD - Economic Development Prospects in Somalia, january 1971.

- SOMALI DEMOCRATIC REPUBLIC - Development Program 1971-1973.

- SOMALI DEVELOPMENT BANK - Fifth Annual Report and Statement of Accounts, 1973.

- SOMALI DEMOCRATIC REPUBLIC - Development Program 1974-1978.

- UNDP - Project for the water control and management of the Shebeli River.

- P. VECELLIO - Indirizzi per lo sviluppo dell'economia della Somalia, 1963.

- MINISTERO LAVORI PUBBLICI - Rapporto sulla possibilità di valorizzazione delle fasce rivierasche del Giuba.

- INTERNATIONAL COOPERATION ADMINISTRATION - Inter-River economic Exploration: the Somali Republic, january 1961.

- CITACO - Development Projects Planned in Lower Juba and Constraints to their Implementation, april 1974.

- SELCHOZPROMEXPORT - The Juba River Scheme, Moscow 1965.

- ITALCONSULT - Lower Juba Region Development Plan, may 1968.

- SELCHOZPROMEXPORT - Project report on irrigation of land under the cotton and oil crops state farm in the Republic of Somalia, 1965.

CLIMATOLOGY

- EAST AFRICAN METEOROLOGICAL DEPARTMENT - A Rainfall Map of Eastern Africa & Southern Arabia, 1963.

- A. FANTOLI - Contributo alla climatologia della Somalia, O.P.I. (Ministero Affari Esteri), Roma, 1963.

- TOURIST-SOMALCONSORTIUM - Il servizio meteorologico e la climatologia, 1970.

- F. COSTANTINI - Il servizio meteorologico e la climatologia, 1970.

- F. COSTANTINI - Carte mensili dei valori medi di nuvolosità, precipitazioni e venti dominanti in Somalia, in "Rivista Meteorologica Aeronautica", Roma, n. 3, 1970, pp. 58-63.

- F. COSTANTINI - Proposta per la reversibilità del clima in Somalia, maggio 1971.

WATER AND MINERAL RESOURCES

- M.G. JONIDES - Preliminary study on the water resources of Somalia, june 1960.

- AHRENS THOMAS - A reconnaissance ground-water survey of Somalia, East Africa, Report of an E.R.P. Technical Assistance Mission, Rome, november 1961.

- MINISTERO LAVORI PUBBLICI - Progetto per lo studio di corsi d'acqua temporanei da sbarrare con dighe in terra o in calcestruzzo, febbraio 1965.

- MINISTRY OF PUBLIC WORKS - A report on development of water resources in Somali Republic, april - july 1966.

- FAO - Visit of the FAO Regional Water Resources Development Officer to Somalia, 8 - 22 december 1966.

- FAO - Agriculture and water surveys: Somalia, 6 Voll., 1968.

- I.F. PAUTKIN - Catalogue of wells of the Somali Republic, august 1969.

- UNDP - Mineral and Ground-Water Survey: Somalia 1970.

- UNDP - Mineral and Ground-Water Survey, Phase II: Somalia, technical report No. 3, 1973.

- G. ANSALDI - Le acque del Giuba nell'agricoltura della Somalia Italiana, in "Rassegna Economica delle Colonie", n. 5-6; Roma, 1932.

AGRICULTURE

a. General

- FAO - Agricultural Economics and Marketing: Somalia, 1961.

- FAO - Survey of food shortages: Somalia, 1962.

- FAO - The food and agriculture economy, report to the government of Somalia, 1965.

- ITALCONSULT - Diversificazione dell'agricoltura. Studio preliminare, agosto 1965.

- F. LA ROSA - Riflessi sociali dell'agricoltura in Somalia, ottobre 1966.

- FAO - Planning for agricultural development: Somali Republic, 1968.

- IBRD/FAO - Report of project identification to Somalia, crop production, july 1968.

- FAO - Near East region's mission on organization and administration of agricultural research. Country report: Somali Democratic Republic, 1971.

- G. QUERINI - Agricoltura e sviluppo economico: il caso della Somalia, Ed. Ricerche, Roma.

- IBRD/FAO - Somalia: North-West region integrated agricultural development project. Preparation Mission, Vol. I, main text, january 1974.

- FAO - Agricultural Engineering Mission, Somalia, 1974.

- MINISTRY OF AGRICULTURE - Crash Programme 1974-1978.

- F. LA ROSA - L'agricoltura praticata lungo i fiumi Giuba e Uebi Scebeli, ottobre 1966.

- ELECTROCONSULT - Stazione di moltiplicazione vegetale. Progetto di pre-investimento, giugno 1967.

b. Production Sectors

- COLONIAL OFFICE - Underground storage of grains, 1956.

- FAO - Report to Somalia, grain silos, 1964.

- ITALCONSULT - Diversificazione dell'agricoltura, agosto 1965 : Vol. II, il cotone e l'arachide - Vol. III, banano, pompelmo, anacardio, dattero, avocado.

- HENDRIKSON - Feasibility study on renovation and enlargement of grain storage facilities in Somalia, 1966.

- F. LA ROSA - La bananicoltura come fattore economico-sociale di primaria grandezza, dicembre 1966.

- FAO - Marketing of bananas: Somalia, 1967.

- FAO - Banana production: Somalia, 1967.

HENDRIKSON - Reconnaissance study on sisal in Somalia, march 1968.

- ENTE NAZIONALE BANANE - Proposta di interventi per la ristrutturazione e la diversificazione colturale dei comprensori bananicoli somali, maggio 1971.

- MINISTERO PIANIFICAZIONE - Progetto pompelmo, schemi preliminari e proposta per il progetto esecutivo, agosto 1971.

- CITACO - Indagine sulla domanda e offerta di olii commestibili in Somalia, dicembre 1971.

- FAO - Grain marketing, storage and price stabilization: Somali grain storage and crop protection, 1971.

- NATIONAL BANANA BOARD - Proposals for the financing of infrastructures on behalf of Somali banana production, 1971.

FAO - Cotton production, Somalia, 1971.

LIVESTOCK

General

FAO - Improvement of the livestock industry, Somalia, 1960.

FAO - Animal production and health, Somalia, 1963.

- MINISTRY OF AGRICULTURE - A scheme for the development of the livestock industry through livestock development fund, september 1965.

FAO - Range management potential in the Somali Republic, june 1966.

MERRIT - Range Ecology Survey.

FAO - Livestock development survey: Somalia, 1967.

FAO - The control of tse-tse fly: Somalia, 1967.

FAO - Livestock development and marketing: Somalia, 1971.

- FAO - Prospects for production, marketing & trade in livestock and livestock products in Eastern Africa to 1985, october 1972 (pp. 1-18).

- FA0 - Development of the livestock industry, Somalia, 1972.

- MINISTERO ZOOTECNIA - Foreste e Pascoli, Estensione degli interventi in favore della zootecnia somala, marzo 1972.

- LIVESTOCK DEVELOPMENT AGENCY - Beef and milk from sugar cane, february 1973.

- CITACO - Ingrasso di bovini con canna da zucchero sfibrata, maggio 1973.

- MINISTRY OF RURAL DEVELOPMENT AND LIVESTOCK - Short term development programme 1971-1973.

- CITACO - Piano globale degli interventi nella produzione della carne in Somalia, novembre 1973.

- IBRD - Livestock development in the Lower Juba, 1971.

- DEMOCRATIC REPUBLIC OF SOMALIA - Trans-Juba Livestock development project, october 1972.

b. Infrastructure

- ELECTROCONSULT - Infrastrutture per l'allevamento in una zona pilota.

- HENDRIKSON - A programme for the allocation of deep wells to the rural areas, march 1973.

- CITACO - Maize-Sorghum sileage as alternative to sugar cane in cattle feeding, 1973.

- CITACO - Remarks on the FED project No. 215.016.24, Sanitary and quality improvements of livestock for internal market and for export, december 1974.

- ELECTROCONSULT - Infrastrutture per l'allevamento, II fase. Parco di attesa e quarantena del Basso Giuba. Pista Jak Bravai-Baale, Capitolato d'appalto, aprile 1970.

FISHING

- T. THUROW - Report on the fishery conditions in Somalia, Kiel, october 1962.

- ITALCONSULT - Diversificazione dell'agricoltura, agosto 1965: Vol. IV, l'allevamento e la pesca.

- UNDP - Proposals for a pilot project for the development of coastal fishing in Somalia, august 1969.

- FAO - Fishery survey: Somali, the tuna fishery of the Gulf of Aden, 1970.

INDUSTRY

a. General Aspects

- ILO - Report to the Government of the Republic of Somalia on the development of handicrafts and small scale industries, 1963.

- M.E. SALAMA - Report on industrial development in Somalia, april 1969.

- R.N. MISRA - Programme for small scale industrial development, june 1971.

- UNIDO - Report on the creation and establishment of a Somali Industrial Development Corporation, april 1971.

- UNIDO - Report on industrial development in the Somali Democratic Republic (by A.M. El-Barbary); august 1971.

- UNIDO - An industrial survey of Somalia, december 1973.

- MINISTRY OF INDUSTRY - Handicrafts of Somalia.

- UNIDO - Small industries development proposal and programs for its achievement in Somalia, july 1974.

- ASSOCIATED CONSULTING ENGINEERS - Feasibility Report on the establishment of industrial estates at Mogadishu, Kismayo, Hargeisa & Baardheere, october 1963.

b. Processing of Agricultural Products

- HENDRIKSON - Feasibility report on fibre production of banana trunks in Somalia, may 1965.

- HENDRIKSON - Feasibility report on the production of banana powder in Somalia, 1965.

- CREDITO SOMALO - Feasibility study for a vegetable oil industry, may 1968.

- HENDRIKSON - Report on production and marketing of gums and resins in Somalia, march 1968.

- RAMBELLI - Liofilizzazione delle banane, 1970.

- HENDRIKSON - Feasibility study on a tomato paste factory in Somalia, april 1972.

- E.C.A. - Particle board manufacture from bagasse in the Somali Democratic Republic, february 1970.

- HENDRIKSON - Establishment of a milling industry in Somalia, march 1973.

- CITACO - Feasibility study on fish meal production from the ichthyic fauna of the Shebeli river, july 1973.

- CITACO - I presenti e i futuri programmi dell'industria olearia somala, ottobre 1973.

- HENDRIKSON - The Kismayo meat factory: project analysis and discussion of appropriate alternatives, january 1968.

- CITACO - Studio di preinvestimento per l'avviamento di un complesso saccarifero da inserirsi nel Juba River Scheme, zona Baardheere-Ionte, dicembre 1972.

- FAO - Grain marketing and storage: Somalia central grain storage, april 1973.

- CITACO - Final design of a grapefruit plantation, july 1974.

- HENDRIKSON - Feasibility study of a cotton production project in Somalia, july 1974.

- MINISTERO PIANIFICAZIONE - Progetto oleaginose: richiesta di finanziamento, febbraio 1972.

- FAO - Problems of grain storage: Somalia, 1975.

- ENTE NAZIONALE BANANE - Statistiche 1971, 1972, 1973.

- DEVELOPMENT CONSULTANTS ASSOCIATION - Lower Juba Project: Agro-Industrial Complex, Vol. I, feasibility study, Cairo, march 1969.

- HENDRIKSON - Analysis and economic evaluation of the feasibility study on the Lower Juba Project, Agro-Industrial Complex, september 1969.

c. Other Industries

- ASSOCIATED CONSULTING ENGINEERS - Feasibility reports on manufacture of terry towels, aluminium utensiles, warp knitted fabrics, november 1963.

- QUINCY MARKET - Freezing plant and fishing operations in the Somali Republic, september 1964.

- FAO - Hides, skins and leather industries: Somalia, 1965.

- HENDRIKSON - Feasibility study on cement production in Somalia, december 1966.

- CREDITO SOMALO - Feasibility study for a corrugated shipping container industry in the Republic of Somalia, november 1967.

- LIVING SERAJEVO - Final project report for the construction of the foundry and the mechanical workshop in the Democratic Republic of Somalia.

- ITALCONSULT/UNIDO - Repair and maintenance of industrial equipment in the developing countries: field survey report in Somalia, march 1969.

- FAO - Hides, skin and leather marketing problems: Somalia, may 1969.

- HENDRIKSON - Reconnaissance study on manufacturing of aluminium utensiles, october 1971.

- HENDRIKSON - Feasibility study on a laundry and toilet soap factory in Somalia, march 1972.

- CITACO - Considerations on the establishment of fertilizer plants in Somalia, march 1972.

- HENDRIKSON - The hides, skin, leather and footwear economy in Somalia, june 1972.

- FAO - Training Centre for hides, skin and leather development, 1973.

- HENDRIKSON - Sectorial survey on construction materials, march 1973.

- NATIONAL HOUSING AGENCY - Development of the building materials industry in Somalia (by Mr. Stefanof/UNIDO), may 1973.

- FAO - Feasibility study for establishing wet chrome leather production unity in Kismayo meat factory, october 1971.

TOURISM

- CLAUSER - Dall'Oca, Pavan, Foreste, fauna, parchi nazionali e conseguenti sviluppi turistici in Somalia, 1969.

- UNDP/ECA - Possibilities of tourism development in Somalia, november 1971.

- HENDRIKSON - Possibilities for a tourism industry in Somalia, june 1972.

- STUDIO TECNICO INGEGNERIA (STI) - Pianificazioni turistiche regionali per la Somalia.

INFRASTRUCTURES

- MINISTRY OF WORKS - Programme for the construction of 6 bridges in the Somali Republic, 1965.

- L.C. GRIMBLE - Scope and procedure for a future comprehensive transportation study, july 1966.

- L.C. GRIMBLE - Transportation study: Republic of Somalia, july 1966.

- RENARDET-SAUTI - Costo dei trasporti in Somalia, gennaio 1968.

- RENARDET-SAUTI - Norme di progetto, 1969.

- MINISTRY OF INDUSTRY - The Mogadishu power supply; an introductory analysis (by R.V. Roggiero/UNIDO Advisor), march 1968.

- U.I.T. - Le telecomunicazioni nella repubblica somala, 1971.

- SDR - Highway Development programme. Consolidated final, september 1970.

- SDR - A report on an international road link between the Republic of Kenia and the Somali Republic, october 1969.

- MINISTRY OF PUBLIC WORKS - Report on bridge over river Juba near Luuq Gannane. Preliminary design.

- ITALCONSULT - Shalambood-Jilib Road. Feasibility report, june 1963.

- CITACO - Aereoporto di Baardheere. Rapporto tecnico-economico, 1975.

- SDR - Arara-Jamaame-Camsuma Road, 1973.

- ITALCONSULT - Interim report on final design of the regional airports of Kismayo, Baydhaadhe, Belet Uen, Galcaio, Buur and Bosaso, 1963.

MISCELLANEOUS

- ISTITUTO AGRONOMICO DI FIRENZE - Contributo ad una bibliografia italiana su Eritrea e Somalia fino al dicembre 1962, agosto 1963.

- P. CONTINI - The Somali Republic, an experiment in legal integration 1969.

- UNESCO - National Science Policy: Somalia, february 1969.

- REGIONAL EDUCATIONAL BUILDING INSTITUTE FOR AFRICA - Building for Education: Somalia, october 1969.

- MINISTERO DELL'INTERNO - Spese di pubblica utilità realizzate dalle amministrazioni municipali e dal dipartimento di sviluppo comunitario nell'esercizio 1971.

- MINISTRY OF THE INTERIOR - Report of the National Commission on local government reform, august 1971.

- MINISTERO DELLA PIANIFICAZIONE - Università Nazionale Somala: studio delle prospettive di sviluppo, ottobre 1971.

- MINISTRY OF HEALTH - Deficiency in the somali diet; survey and evaluation, 1972.

- ILO - Report to the government of the Somali Democratic Republic on the integrated development of the nomadic zones, 1972.

- UNESCO - Educational planning august 1970 / april 1972 in the Somali Democratic Republic, january 1973.

- UNESCO - Ecological considerations on land use effects in two regions of Somalia, may 1973.

- MINISTRY OF LABOUR AND SPORT - Sport in Somalia, 1975.

- REGIONE DEL BASSO GIUBA - Basso Giuba nell'anno 1971, 21 ottobre 1971.