SOMALI DEMOCRATIC REPUBLIC

MINISTRY OF AGRICULTURE

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NORTH - WEST REGION AGRICULTURAL DEVELOPMENT PROJECT

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FEASIBILITY STUDY AND TECHNICAL ASSISTANCE

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TECHNICAL REPORT N° 6

RANGE AND LIVESTOCK SURVEY

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CONTENTS

SUMMARY AND CONCLUSIONS

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1. GENERAL CONSIDERATIONS

The project zone, which covers 33 500 km2, includes the districts of Saylac, Lughaye, Gebiley and Boorama, and a part of the districts of Berbera and Hargeysa. The region consists of three major natural zones, - the coastal plain, the mountain range and the plateau.

The hydrographic network may be briefly described as consisting of four main catchment areas (those of the Silil, Col Fuul, Biji and Waheen) which drain from the plateau towards the sea.

Climatic conditions are of the semi-arid type, and precipitation varies from less than 100 mm on the coast to more than 600 mm in the highest mountain areas. The differences in temperature between the coastal plain and the plateau vary according to the season, with the greatest differences occuring in the summer (the thermal gradient, which is 0.4°C/100 m of altitude, in the winter, doubles in the summer). Average monthly temperatures during the hottest months are about 25°C at Hargeysa and 35°C at Berbera, and during the coldest months 20°C at Hargeysa and 25°C at Berbera.

The rainfall regime is characterised by two succesive seasons separated by the month of June, during which rainfall is slightly less than before or after. In the plateau and mountain areas, the rainy season usually lasts from March to September, with the driest months being December and January. In the other hand, in the coastal plain, the wettest months are during the winter (November, December and January).

One characteristic climatological feature of this region is the "Kharif" wind, which blows violently from the south west from June to September.

2. VEGETATION

2.1 QUALITATIVE ANALYSIS

Five bioclimatic zones were defined, each characterised by speci climatic and geographical conditions. Within each of these five zones, a number of different ecosystems were described.

The coastal zone, ranging in altitude from 0 m to 350 m, varies i width from 80 km at Saylac to 20 km near Berbera and consists ess tially of Quaternary alluvium. The climate is arid, with precipit tion occurring mainly in the winter months and not exceeding 150 The total area covered represents 89 480 ha or 27.8 % of the enti study area.

Eight ecosystems were distinguished in this zone:

- Two are halophytic communities, characterised by Suaeda monoi or Aeluropus lagopoides;
- Four are typical communities characterised by Panicum turgidu Balanites orbicularis, or Acacia spirocarpa;
- Two are subriverine communities characterised by Tamarix nilo or Leptadenia pyrotechnica.

The subcoastal zone covers 26.1 % of the north west region, ie. an area of more than 876 000 ha. This is the most unfavourable bioclim zone, where conditions are very hard. The area is located at altitu of between 350 m and 900 m, extending from the end of the coastal p to the first spurs of the mountain range, with an average width of to 30 km. Rainfall varies from 150 mm to 250 mm per annum and occur in the form of very localised showers, mainly during the winter. Th zone is a mosaic of small plant associations, which are governed by local variations in soils and water supply. Depending on the area, species from the coastal plain also appear, together with others fr the Acacia zone. Seven ecosystems were distinguished in this zone:

- Three typical communities (Acacia - Commiphora scrub type);
- Two edaphic communities (Rhigozum somalense xerophytic communi and Iphiona rotundifolia Grassland community);
- Two subriverine communities (Salvadora persica - Dobera Glabra and Balanites orbicularis - Acacia tortilis).

The Acacia bussei zone covers 21.4 % of the area, or 718 000 ha, extending from 900 m to 1250 m altitude. This is the most extensive area of former Somaliland, covering in all about 50 000 km2. Rainfall varies from 250 mm to 350 mm in the area studied. The entire zone is characterised by the presence of Acacia bussei (Galol). Seven dominant ecosystems were distinguished in this zone, according to the phygsionomy of the community (open or dense woodland, open scrub) and to the vegetal composition of the community.

- Four are typical communities, and
- Three are edaphic communities (open grassland, 'vegetation arcs').

The Acacia etbaica zone covers 21.8 %, or 750 000 ha, of the study area, varying from 1250 m to 1500 m altitude. The annual average rainfall varies from 350 mm to 550 mm according to the location. The zone extends into the highest mountainous areas and over all the plateau area situated to the west of Hargeysa. This is the climatic zone which is best suited to receiving centres of human activity, and it is for this reason that rainfed agriculture has developed in the zone (almost 24 000 ha are already under cultivation). This is also the zone which has the highest fodder productivity. However, the development of both agriculture and stock-breeding is hindered by the random distribution of rainfall over the year. Five different ecosystems were distinguished in this zone.

Three are typical communities (open woodland and scrub), one is an edaphic community (Chrysopogon aucheri on the clayey soil of Wapale plain) and

- One is a subriverine community.

The evergreen zone only covers 2.2 % of the study area, or 72 000 ha, and is the most temperate of the north west's zones. It is generally situated above 1400 m altitude, and receives annual rainfall of between 550 mm and 650 mm. The zone is limited geographically to a few small sites, which are difficult to reach (except in the case of Gacan Libaax), and the main interest is, in fact, botanical, as it is in these areas that some relic forests of Juniperus procera survive.

- Three typical communities were described, the Buxus open scrub, the Dodonea scrub and the Juniperus procera forest.

2.2 PRODUCTION ANALYSIS

An analysis was carried out of plant production in each of the ecosystems. The main aspects of the method of approach were as follows:

- The whole herbaceous layer was taken into account as well as the leaf production in the first two metres of the shrub layer;
- The fact that there are two successive rainy periods during the year means that two new growths may be considered in the case of the herbaceous layer, 1.5 in the case of the shrub layer (the second is less significant);
- Only one growth has been considered in the case of the herbaceous and shrub layers of the coastal and subcoastal zones;
- The potential which can be consumed by animals was estimated at 50 % of the total herbaceous production and 40 % of the leaf production.

The results, compared with the bioclimatic zones, and expressed in terms of carrying capacity, are as follows:

Bioclimatic zone	Total area (ha)	% of the studied area	Total carrying capacity (LU/year)	Carrying capacity (Ha/LU/year)
Coastal	932 120	27.8	60 530	15.4
Sub coastal	876 630	26.1	24 560	35.7
Acacia bussei	717 760	21.4	92 700	7.7
Acacia etbaica	729 520	21.8	152 930	4.8
Evergreen	72 520	2.2	5 780	12.5
Cultivated area	23 650	0.7	16 900	1.4
Total area	3 352 200	100.0	353 400	9.5

3. POPULATION

The total estimated population of the North West Region in 1980 was 600 000, and out of these more than 150 000 were refugees. The number of individuals involved in nomadic stock-breeding has been estimated at 145 000. The population is distributed in a very irregular fashion according to district, sex and age and it is estimated that almost three-fourth of the inhabitants live in the regions's three main towns. The emigration of 30 000 individuals mostly male labour force is also an important phenomenon in the North West Region which affects some 19 000 families (ie. 36% of the total families).

4. PASTORALISM

Common law and traditional rules governed the organisation of the pastoral communities and the allocation and rise of the range and water points. This was abolished by a law passed on November 1st 1970. However the ways in which pastoralists manage the range still reflects some of the former grazing patterns.

Transhumance is and will remain necessary in this semi-arid region often subject to climatic irregularities.

Not all the members of the production unit will participate to the transhumance. And in a 'normal year' for each pastoral group, migratory movement of livestock though opportunistic will take place within traditional limit.

The movements are so organised to have the livestock graze and/or browse alternatively the coastal and highland rangelands. They can however be modified under the pressure of external causes (climatic, animal disease, etc.).

In the north west, pastoralists raise primarily small ruminants and camels without any apparent breeding specialization. The different stocks are usually herded separately; some of the milking animals are left behind for those members of the family who stay in the camp.

In most occurencies, in the dry season, watering of animals is done from traditional wells or boreholes with very rudimentary techniques.

In the north west, a bad distribution of the water points involves a bad distribution of animals, with a concentration in the places where water is easily accessible (toggas, gullies...) and restricts the movement of the herd due to the watering intervals.

5. LIVESTOCK PRODUCTION

The livestock raised in an extensive mode in the area is composed of cattle, sheep, goats and camels belonging to breed that are perfectly adapted to the severe environmental conditions.

Lack of data on livestock distribution and performances restrict long term planning and the definition of any adequate development programme. However, in the absence of a proper survey, field investigations will give some indications.

The proportion of females would vary between 60 % to 70 % among the breeding herds of cattle or camels, and females would be kept up to the end of their productive life. For small ruminants, this proportion could not be known. The size of cattle herds would vary between 10 to 40 heads that of small ruminants between 80 to 100 heads. Camel herds can also be quite large.

The fertility rates of the different type of stock is generally rather low.

The mortality rate is quite high especially among young animals. It is very high in period of drought with the highest losses among the sedentary herds which can reach, after the drought of 1980, up to 2/3 of the livestock (PIU's survey 1979-1981).

The overall offtake rate seems to be very similar to that of other semi arid countries and would stand around 11.9 % for cattle, 30 % for sheep and goats and 8 % for camels.

The sale of small ruminant is a major source of cash income for the pastoralists. Much of the domestic consumption is made of old females and camel meat is most commonly eaten in the rural areas.

Males are generally marketed at the adult age of 2 years for sheep, 8-9 years for camels, 4-5 for cattle.

During the transhumance, milk is the basic food for the pastoralists and is also marketed in urban areas in the rainy season.

Camel is the most rustic animal; its milk production is the highest (3 to 12 l/day) and considered a delicacy by the somali consumer.

Animal traction has long been known among the somali population. Either cattle, camels or donkeys are used as draft animals. Whenever needed, heavy duties are carried out by oxen. Oxen are the most valuable draft animals, fattened for a short period they can be marketed at a fairly high price, thus providing an additional revenue to the farmers.

6. LIVESTOCK POPULATION

In 1980, there had been no valuable estimation of the livestock population most of them varying in too high proportions to be utilised or adjusted.

On the basis of marketing statistics for the year 1979 and using accepted parameters on livestock productivity the probable average livestock population in the north west region was estimated as follows for the dry year 1979-80:

	Number of heads	Heads/km2
Cattle	120 000 to 145 000	2.7 to 3.3
Camels	160 000 to 180 000	3.6 to 4.3
Sheep and goats	2 200 000 to 2 500 000	49.0 to 57.0

Translated into livestock units (LU) these figures give an average livestock biomass of 0.11 LU/ha.

Confronted to the average annual range carrying capacity they reveal a 'chronical' overgrazing of the region. Animal losses occurring during the droughts are a direct consequence of this situation. A pilot field survey conducted by the consultant in September 1980 by the end of the drought in the project study area (33 522 km2) reflect the specific conditions of that period.

The livestock population estimate in the project study area in september 1980 is as follows:

. Cattle	39 800
. Camel	121 500
. Sheep and goats	360 300

This seasonal estimate reveals that pastoralists have been altogether very consistent in the management of their herds with respect to the range capacity as a result of only one rainy season. Most of the herds had left the region and migrated into the Ogaden, thus minimizing the losses. Only sedentary stocks were severely affected. Though no direct comparison can be made, the preliminary results from the actual resource inventory (RMR) of 1981 stresses out this fact.

With respect to the regional distribution of the livestock, a close correlation has been observed between animal biomass and plant biomass. Thus, in september 1980, close to 80 % of the livestock had concentrated in the two bioclimatic zones of Acacia etbaica and Acacia bussei. Sheep and cattle were predominant on the Plateau (Acacia etbaica) which offers more moderate temperature and a more developped herbaceous layer while goats and camels could mostly be found in more woody and bushy areas.

In these semi arid regions subject to irregular climatic conditions, transhumance and animal mobility are and will remain a necessity. Consequently producing estimates of a livestock population which is governed by an extensive mode of production is a difficult exercise. Any such figure reflects the date and period in which the survey was conducted. Therefore it is subject to great fluctuations.

Any estimate has then to be examined very carefully and merely regarded as an indicator of the existing situation.

In that respect, only comprehensive range and livestock management schemes, well monitored and in which pastoralists would be granted grazing rights, will contribute to the development of the livestock sector. Such schemes are the responsability of NRA. Otherwise, in the north west, animal production can be developped in association with agriculture.

7. ANIMAL HEALTH

The animal health situation in the north west reflects both the diseases specific to the migrating herds of the region and those brought in by herds for exports, and the prophylactic measures provided by the Department of Health in the MLFR.

Budget allocation (67.2 million sosh in 1979) to the veterinary services has always been insufficient and far below the accepted norms for animal health in semi arid countries. The share of the national budget to the Ministry of livestock has constantly decreased from 5.4 % in 1974 to 3.7 % in 1979.

It is obvious that there has been no proper prophylaxy since the JP 15 campain ended in 1975.

The MLFR regional infrastructure consists of a main centre in Hargeysa, six secondary centres in the main towns of the various districts and at least 22 veterinary posts. All these substations are staffed with one animal health assistant.

Besides, the activities of the Department rely on the works of the veterinary Laboratories of Hargeysa and Mogadishu which is also responsible for vaccine production. As a result of a lack of means and resources and a defective organisation, the activities of the Department of Animal Health in recent years have been curative oriented rather than focused in the prevention of the main enzootic diseases.

Vaccination against the main contagious diseases (Rinderpest, CBPP, Anthrax, Black Quarter, CCPP, HS, sheep fox and enterotoxemia...) is administered free of charge by the personnel of the mobile unit of the MLFR.

VACCINATIONS IN 1979					
	Rinderpest	CBPP	BQ	Anthrax	Sheep fox
North west	84 874	30 460	11 080	64 560	18 400
Somalia	794 000	959 000	475 000	782 000	156 000

Source: MLFR

These vaccination benefit essentially to herd for export. On the other hand pastoralists pay for mass or individual treatment (Trypanosomiasis, Endoparasites and Ectoparasites). Drugs are sold at the stations and substations and by the mobile units.

TREATMENTS IN 1979						
	Sheep and goat		Cattle		Camel	
	North west	Somalia	North west	Somalia	North west	Somalia
Trypnosomiasis	-	92 464		513 697		5 769
Ectoparasites	65	222 775	939	993 497	4 099	1 136 126
Endoparasites	34 711	333 767	1 156	36 706	34 711	65 035

Given the present animal health situation, its seems unwise to envisage the implementation of animal production schemes without first allocating adequate funds to the veterinary services in order to develop an efficient Department of animal health capable of carrying out preventive vaccination campaigns, and supplying the pastoralists adequately with drugs.

8. MARKETING

Animal production is the major economic activity of Somalia and the main source of foreign currency. In 1979, it accounted for 87 % of total exports in value (600 million Sosh), of which 555 million Sosh was livestock mostly sheep and goats. Hides and skins make the complementary exports.

In the Three Year Development Plan (TYDP), this sector was given priority and thirty two projects, representing a total of 630 million Sosh were programmed, seven of which (137 million Sosh) concerned the north west region and five dealt with marketing.

Since 1966, marketing and export of livestock was officially the responsibility of state or parastatal institutions. However, in practice the marketing of livestock and meat remained in the hands of the private dealers.

In 1981, the marketing, monopoly for livestock was abolished and the installations have become the responsibility of the NRA whereas for hides and skins it is still a state monopoly. The Hargeysa branch of the hides and skins Agency provides about 67 % of the dried skin exported from Somalia (1 100 000 units).

Marketing of livestock is done through two main different circuits, depending on whether animals are intended for the domestic or foreign market. Exporting females is forbidden.

A great number of animals for export are not traded on markets, except in the vicinity of the Ogaden border. Dealers usually employ collecting agents who buy directly from the pastoralists in numbers. Final sorting out of animals is currently done at the regrouping market centre of Hargeysa.

Available statistics on market sales, animals slaughtered etc. are too fragmentary and insufficient to assess the total off-take of animals. This can only be determined through proper inquiries.

In 1980, prices quoted and recorded for livestock were in the line with those prevailing in other pastoral african countries with probably an over pricing of sheep whose flesh in very much prized in the Arabian peninsula.

The marketing of milk is at present a purely seasonal activity. Developping camel milk production in agro-pastoral farms has to be given consideration.

Most of Somalia livestock exports is done from Berbera (80 % in numbers) to the Arabian peninsula of which 95 % go to Saudi Arabia. Exports to Djibouti and Kenya are unknown as well as the number of animals from neighbour countries transiting through Berbera.

After the 1974 drought and up till 1979, there has been a constant increase in cattle and sheep and goats exports whereas there has been a marked decline in the number of camels exported. This reflects a change in the demand pattern of the main customer: Saudi Arabia.

LIVESTOCK EXPORTS IN 1974 AND 1979

	Cattle	Sheep and goats	Camels
1974	39 472	1 238 500	23 965
1979	67 886	1 452 200	12 508
1979/1974	1.72	1.17	0.52

The national authorities and dealers have become aware of these changes and of the threat of the competition from other countries (Australia, Sudan, Ethiopia...). They have attempted to improve the organisation of exports find new market and even promote the exports of processed products. This has resulted in the creation of the Committee of livestock dealers, the Somali Shipping Company, and a Hides and Skins Industry.

However many constraints have still to be overcome with respect to the marketing facilities for export, the shipment, the organisational and management aspect of this activity, the operation of a processing industry (skin or leather) to maintain or improve the level of exports and consequently the national foreign revenue.

9. RECOMMENDATIONS

Animal health and nutrition problems hamper the development of livestock production and productivity in the north west of Somalia. Trying to overcome them requires preliminary actions in the field of Animal health for the prevention of the main enzootic diseases and the control of parasites. In this respect, two recommendations can be made: one is to rehabilitate the Animal Health services; the other would be the creation of a regional pharmacy placed under the authority of MLFR. The distribution of the common drugs would be in the hand of the private sector. These two proposals have been described in detail in the NRDP Phase II Identification Project Document of which they are key aspects of a proper range management programme.

A number of other recommendations or project proposals can be thought of regarding range management and fodder production in the extensive livestock breeding system. This can be envisaged through the implementation of a comprehensive range use plan while would fully integrate the four factors: pastoralists, livestock, vegetation and water availability. Having the confidence of the pastoralists is a condition for the success of such a project. The granting of exclusive grazing right to pastoral communities is a way to achieve this objective. The definition and implementation of a range management programme is the responsability of NRA. Actually, for the north west region, this has already been considered in the NRDP phase II project identification.

Intensive livestock production can be better developped in association with agriculture. On that respect, the implementation of dairy camel pilot agro-pastoral farms in peri-urban areas for milk production seems interesting. Camel milk production in the pilot farm will be conducted as an integrated activity associating migratory, herding to agricultural production. The farm would be organised in line with the traditional herd management practices; and the females would remain in the farm when their lactation is maximum, starting just after giving birth.

The camel pilot dairy farm would keep permanently 7 lactating females coming from the migratory herds and which would return in the herd after 7 months in the farm. It is expected that these females which would receive supplementary feeding and well balance rations would produce about 12 600 litres in each production cycle.

Animal gross income for the farmer for two cycles of production has been estimated between about Sosh 50 000 and Sosh 63 000, later cost excluded on the assumption of a market price of Sosh 6 to 6.5 per litre.

In this scheme some of the food either fodder foliage and cultivated forage would be produced on the farm.

The other intensification in livestock production which would also benefit to agricultural, concerns draft animals. This can be done through a more rational use of these animals, an adapted nutrition and the improvement of their power efficiency.

A more rational use of oxen, means a productive period as draft animals of 3 years, starting at the age of 3-4 years at the end of which a fattening period of 3 months would allow to sell them as beef cattle for export thus bringing an additional revenue to the farmer.

Assumption have been made that most if not all their food, except the mineral supplement, would be provided by the farm. This means that most likely, fodder trees should be planted in the farm as wind breaks for exemple as well as some fodder crops introduced as part of a cropping rotation. This will have to be experimented in the pilot farms first.

In addition, the power efficiency of draft-animals will be improved with the introduction and marketing of new implements. This can be done through the installation of a fabrication and assembling unit like those already installed in countries in tropical africa which would produce farming equipments like implements for cultivation and transport. The production unit to install could be either carry out all the production or produce some of the sophisticated part of the equipments, while village blacksmith would assemble and weld the different elements together.

A number of parts will have to be imported and the type of implements to be selected for the region will have to assimilate to a well-known basic implement which could be adapted. The total investment required for the installation of this small industry can be estimated in first approximation at million Sosh 2.5. The objective of such investment is to develop a local industry and promote village professionnals, like blacksmith, falls into the financial aids granted by UNIDO which also could provide the technical assistance (UN volunteer). A training programme should be included in the project.

However specific studies still have to be conducted: its feasibility, its production capacity. This can only be done once the implements have been selected.

Finally, with respect to marketing, the reorganisation, rehabilitation and reconstruction of the livestock marketing facilities appears necessary. Since 1981, this has become the responsibility of NRA. As such, it has been examined as part of the NRDP Phase II project identification study document.

INTRODUCTION

This study was performed according to the specifications set by the revised proposal which state :

"After a review of existing documents and available information, a general (...) land inventory of the North West Region area will be carried out using the following method : (...)

(iv) Identification, evaluation and delineation of range sites, based on sample study of plant communities in relation to land forms and hydrology ;

(v) Identification of areas where soils are suitable for (...) grazing.

The study will include some amount of forage plant analysis (...)

The following map will be produced : range site map.

(...) a survey will be made of the potential for improvement of livestock and animal husbandry. The study will concern specially the following aspects :

- rough estimate of the present livestock,
- local breeds and their characteristics,
- current practices and veterinary organisation,
- potential for animal production under improved range and livestock management,
- specific actions required for the development of animal production."

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Part I

VEGETATION SURVEY

NORTH WEST REGION AGRICULTURAL DEVELOPMENT PROJECT

Feasibility - List of reports

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A - INVENTORY STAGE REPORTS

31 0297 R0 - Inventory stage - Interim Report

31 0297 R1 - Technical Report No. 1 - Geomorphology

31 0297 R2 - T.R. No. 2 - Climatology

31 0297 R3 - T.R. No. 3 - Hydrology

31 0297 R4 - T.R. No. 4 - Hydrogeology (Preliminary Report) (printed in draft only)

31 0297 R5 - T.R. No. 5 - Soil Survey

31 0297 R6 - T.R. No. 6 - Range and Livestock Survey

31 0297 R7 - T.R. No. 7 - Agronomical Survey

31 0297 R8 - T.R. No. 8 - Soil and Water Conservation

31 0297 R9 - T.R. No. 9 - Population, Demography and Organization of Agriculture

31 0297 R10 - T.R. No. 10 - Economic Survey

31 0297 R11 - T.R. No. 11 - Research and Extension

31 0297 R12 - T.R. No. 12 - Road Survey

31 0297 R13 - T.R. No. 13 - Electricity Survey

31 0297 R16 - T.R. No. 16 - Hydrogeology (final report) Main report, Appendices.

B - PROGRAMMING STAGE REPORTS

31 0297 R14 - Agricultural Development Programme: A. Rainfed Agriculture:

- Annex 1 - Agricultural Development
- Annex 2 - Soil and water conservation works
- Annex 3 - Sociological and Organizational Aspects
- Annex 4 - Economic analysis.

31 0297 R17 - Agricultural Development Programme: B. Irrigated Agriculture

- Main Report
- Annex 1 - Irrigated Gardens Development
- Annex 2 - Ruqi Irrigation Project
- Annex 3 - Agricultural Development Potential of the Lower Basin of Durdur
- Annex 4 - Water Diversion Works on the Togga Ceel Berdale (31 0297 R18 - Final Report).

Chapter 1

ECOLOGY OF THE NORTH WEST

1.1 DESCRIPTION OF THE REGION

The North West region (W. Galbeed) covers an area of about 45 000 km2 ie. 7% of the total area of Somalia. The relief of the area consists of a rugged faulty plateau range, none of the peaks of which exceed 1800 m, which is bordered on the northern side by the coastal plain (below 300 m) and on the south by plateaus which vary from 1000 m to 1500 m.

The province is divided into 6 districts:

Berbera	11 470 km2
Hargeysa	13 150 km2
Gebiley	3 250 km2
Boorama	4 250 km2
Saylac	7 750 km2
Lughaye	5 000 km2
	44 870 km2

The project concerns part of the Berbera and Hargeysa districts and all of the others, ie. an area of about 33 600 km2 studied and mapped.

1.2 POPULATION

Statistics on population in Somalia are quite imprecise and constitute an order of magnitude.

However, in the technical report No 9 on population and demography there has been an attempt to assess the population of the North West region and its distribution.

In 1980, the total population was estimated at 600 000 for the North West. Out of these 150 000 were refugees.

The population in the four main towns apparently amounted to 350 000 distributed as follows:

Hargeysa	277 000 to 320 000
Berbera	21 000 to 31 000
Gebiley	10 000
Boorama	8 000 to 10 000

Among the whole population, it appeared that some 145 000 individuals were involved in migrating stock breeding.

The study drives to the following conclusions:

- an important residential and occupational mobility of this population,
- rapid growth in the population residing in the main urban centers (11% in Hargeysa in recent years) which is counter balanced by a relative stability in the number of people with a nomadic life style.

This means a profound change in the population distribution during the last generation:

- A considerable relation in the number of people whose sole source of income is the pastoral activity;
- A very unbalanced demographic distribution by sex and age partly explained by regional and foreign emigrate.

Yet pastoralism remains the dominant economic activity in the North West, and as a result of social changes and recent regulations, the practice of transhumance has replaced the nomadic way of life which characterized these populations in the past.

1.3 CLIMATOLOGY

Only those phenomena which affect the distribution of vegetation will be dealt with here *. These main features of the climate in the North West are the following:

- Low rainfall, which places the area amongst the semi-arid zones;
- Two monsoon seasons, bringing rain from the North East and later from the South West;

* See Technical Report No 2 on Climatology for the comprehensive study

. A strong wind (important wind factor);

. A marked altitude resulting from the considerable range in altitude.

The first rainy season generally lasts from March to June and the second from July to October. The dry season lasts from November to February.

The second rainy season is accompanied by a strong dry wind, the kharif, which blows constantly for a period of several months.

Table 1.3 (1)

AVERAGE WIND SPEEDS (m/s)

	J	F	M	A	M	J	J	A	S	O	N	D
Gacan Libaax	2.2	1.8	2.0	2.2	2.2	4.3	5.3	4.6	3.1	1.7	1.7	1.5
Geddeeble						3.5	3.8	4.0	2.2			
Laori Bayar	2.7						3.8	3.3	2.6	2.4	2.6	2.5
Ceel Gaal	2.2						4.0	3.6	2.6	2.1	2.0	2.1
Bown	2.2						3.6	3.6	2.3	2.0	2.1	1.9

The wind is one of the most important factors in the North West, in so far as, given its strength and low level of humidity, it considerably increases evapotranspiration from the plants and the risks of erosion in the most exposed sections of the plateau.

For reference, the main climatic information from the Hargeysa and Berbera stations is given below. These two stations are the most representative of the area as a whole, Hargeysa for the plateau region and Berbera for the coastal plain.

Table 1.3(2)

	J	F	M	A	M	J	J	A	S	O	N	D	Mean year
HARGEYSA													
Temperature maxi (mean)	25.1	27.1	24.5	29.4	30.4	30.8	29.8	29.7	30.3	28.6	25.7	24.0	28.0
Temperature mini (mean)	13.7	14.7	17.0	18.4	19.7	18.9	18.8	19.1	18.7	16.3	15.1	14.0	17.0
Temperature mean	19.8	21.1	23.5	24.1	25.2	25.0	24.3	24.2	24.7	22.7	21.2	19.6	23.0
Rainfalls (mm)	3	10	25	63	66	49	44	74	62	22	10	2	430
Mean humidity (%)	70.4	58.4	59.2	51.8	53.4	51.6	51.4	51.4	52.1	50.8	57	64.3	56.0
Prevailing wind	N	N	NE	NE	S	SW*	SW*	SW*	SW*	NE	N	N	N
BERBERA													
Temperature maxi (mean)	28.8	29.1	30.9	31.7	34.9	40.4	40.4	39.8	37.9	33.1	30.8	29.7	33.9
Temperature mini (mean)	21.3	22.1	23.5	25.3	27.3	30.3	31.0	30.4	28.6	25.0	22.7	21.3	25.7
Temperature mean	25.5	26.1	27.0	29.8	31.4	35.0	35.3	35.0	33.5	29.4	27.2	25.8	30.0
Rainfalls (mm)	5	5	12	12	9	1	2	2	2	2	3	4	59
Mean humidity (%)	73.8	74.7	77.0	77.6	70.4	49.8	45.5	47.4	55.6	69.4	70.0	72.4	65.3
Prevailing wind	NE	NE	NE	NE	NE	SW	SW	SW	SW	NE	NE	NE	NE

* Kharif.

Temperature decreases progressively with altitude, following a temperature gradient, the seasonal differences in which have been defined for the Berbera-Hargeysa axis.

Generally, in mountainous areas in tropical monsoon climates, a temperature gradient of 0.4°C/100 m is adopted. In an arid region, this gradient is steeper, reaching an average of 0.8°C/100 m. This is the case in the North West region during the summer months, during which the differences in temperature between Hargeysa and Berbera are the most marked (see graph 1.3 (1)).

The distribution of rainfall and years of severe drought is analysed in detail in Technical Report No 2 (Climatology).

1.4 VEGETATION

1.4.1 BRIEF HISTORY

Botanical research in northern Somalia began in 1853 with the work of Cruttenden, and was continued by Hildebrant in 1873-5. In the field of ecological research, studies are much more recent: Collenette in the North East (1941) and Gillett in the North West and Harar province of Ethiopia (1941). In 1942, Edwards made a general survey of the range land in Somaliland, and in 1946 Gilliland studied the range land in the eastern British Somaliland. This work was completed by Glover (1947), Cufodontis (1954), Pichi Sermolli (1957) and Hemming (1966).

1.4.2 DISTRIBUTION OF VEGETATION

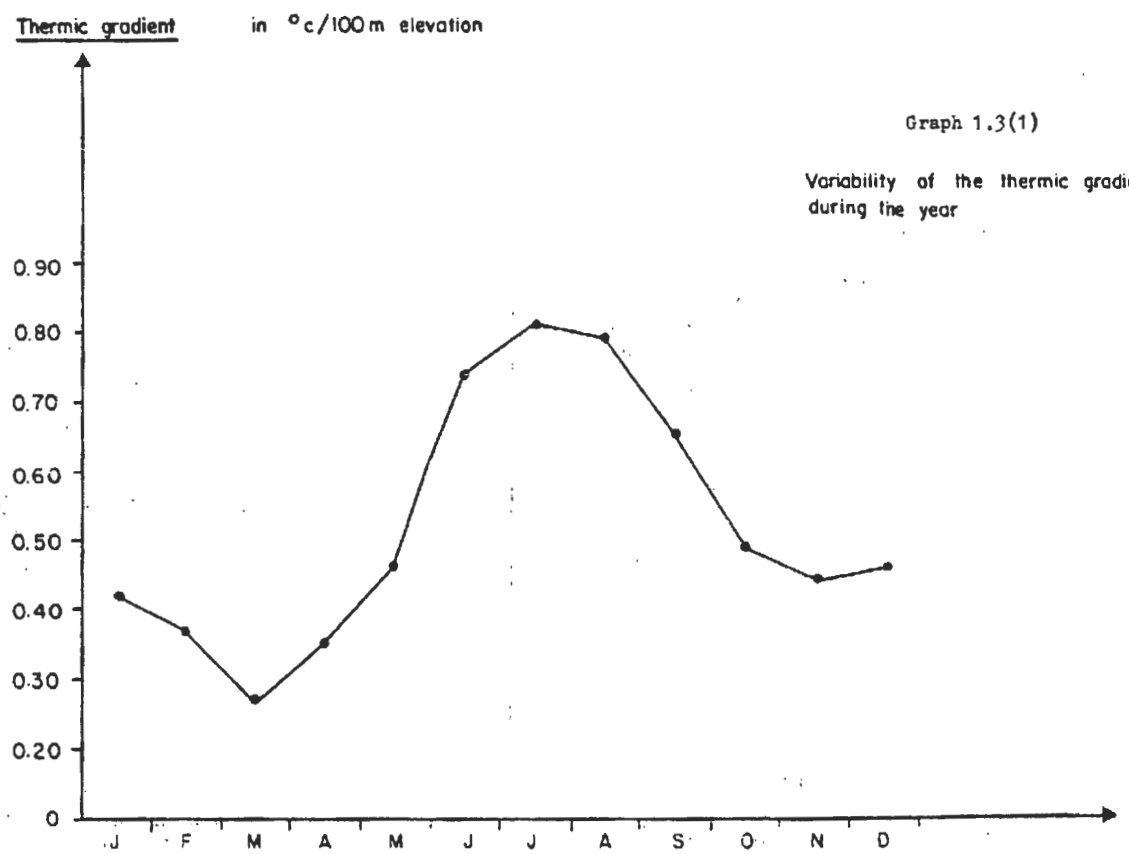
The study carried out in the context of the NWRADP made it possible to define and map in greater detail the plant groups and production of the various ecosystems in the North West. During the Consultant's visit, 250 different species of plants were collected, dried and identified.

One characteristic, which is common to many arid and semi-arid zones, is that there is on the whole very little diversity in the plant life: a plot of vegetation never contains more than 10 species, and in any plant community there are on average only about thirty species.

Five major bioclimatic (ecological) zones were defined, within which there are about thirty ecosystems. The five zones are as follows:

1) The coastal plain;

2) The sub-coastal zone;



Graph 1.3(1)

Variability of the thermic gradient during the year

3) The Acacia bussei zone;

4) The Acacia etbaica zone;

5) The evergreen zone.

The distribution of vegetation is "stratified", due to the effect of altitude on the climatic factors such as the temperature (temperature gradient) and precipitation. Whereas the temperature decreases with altitude, as has been seen, the rainfall increases.

Various studies have been carried out on the relationship between altitude and precipitation (Howard Humphreys in 1960, Hemming in 1966). These studies revealed that the rate of increase in rainfall was not constant, but became greater with altitude. In Nothern Somalia, the increase in rainfall is 25 mm/100 m at 1300 m altitude, rising to 43 mm/100 m at 1700 m altitude (Hemming, 1966).

Following a similar approach, the graph 2.1 (2) has been elaborated with the different meteorological stations situated in each ecoclimatical zone of the North West region, and for which rainfall data were available.

The graph shows that while there may be a relation between altitude and precipitation, this relation is not perfect. However, it reflects a trend. For example, point 10 represents Mandheera and is outside any of the clusters. In fact, the relief in this particular area favours a much higher level of rainfall than might be assumed from its altitude (880 m). Moreover, this heavy local rain is quite obvious at ground level, as Mandheera is situated in an abnormally low zone of Acacia etbaica, and surrounded by rocky slopes, on which there is an evergreen scrub type of vegetation (Buxus hildebrandtii) above 1100 m. The highest point in the area is the Gacan Libaax cliff (1700 m), where there is a relic forest of Juniperus procera (which requires more than 600 mm of rain per annum).

The three points a, b and c represent three meteorogical stations situated in the Acacia bussei zone between Hargeysa and Burao. There are in fact only two places in the study area which belong to this ecological zone (13: Bown and 14: Adadle) but these are situated too near to the lower limit of the Acacia etbaica zone to be truly representative. The stations at Doboweyne (a), El Hume (b) and Odweyna (c) thus strengthen this cluster.

The relationship between vegetation and precipitation is thus much closer than that between vegetation and altitude, but in spite of the closeness of this relationship, it does not explain the complex way in which the climate controls the various strata of vegetation. On the other hand, it does make it possible to affirm that at any given point for which no climatological information is available, it will be possible to assess the mean annual rainfall with only fairly small errors, on the basis of the vegetation.

1.5 FAUNA

In the North West, mainly because of the rigorous climate, the observed fauna is not very abundant, though quite diversified. The following is a list of the main animals observed, together with their habitats:

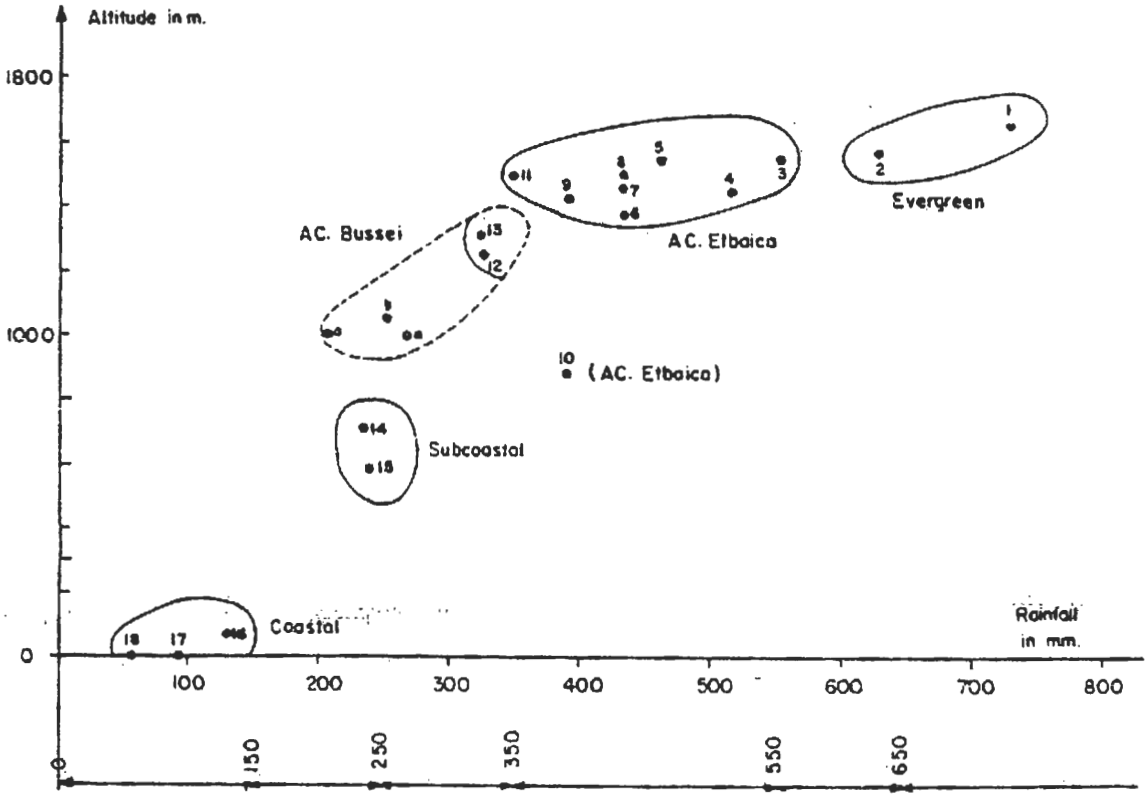
- Dik-dik (Madoqua saltiana). This is found from the sub-coastal zone as far as the Acacia etbaica zone, in all the open woodland and open scrub areas.
- Speke's gazelle (Gazella spekei). Abundant in the coastal plain.
- Ostrich (Struthio camelus). Rare, and observed mainly in the coastal plain and open scrub areas dominating Mandheera.
- Gerenuk (Lithocranius walleri). Found in the open woodland of the Acacia bussei zone.
- Wart-hog (Phacochaerus aethiopicus). This is very common along the Hargeysa-Berbera road in the Acacia bussei zone.
- Cape hare (Lepus capensis). Common on the plateau.
- Ground squirrel (Xerus rutilus). Very common above the sub-coastal zone.
- Jackal (Canis aureus). Very common above the sub-coastal zone.
- Lesser kudu (Strepsiceros imberbis). Observed only once, in the mountains around Ceel Bardaale.
- Caracal (Felis caracal). Observed only once in the sub-coastal zone near the wadi Waheen. Nocturnal animal.
- Mongoose (Herpestes ichneumon). Commonly seen at night in gardens at Hargeysa.
- Ant bear (Orycteropus afer). Rare, only seen at night. Observed twice on the Hargeysa-Berbera road.
- Hamadryas (Papio hamadryas). Common in open woodland in the Acacia bussei and Acacia etbaica zones. It is also a major crop pest.
- Hyena (Hyaena striata). Very common.

Tortoises are common in the Acacia bussei and Acacia etbaica zones. There are numerous birds, especially in the wettest areas and close to the towns. They are a real menace to rainfed crops, especially sorghum and maize, of which they consume large quantities.

Birds of pray, Hyena and Jackal are the most serious predators for the livestock.

Figure 1.4(1)

RELATION BETWEEN ALTITUDE AND RAINFALLS
FOR 21 METEOROLOGICAL STATIONS OF THE NORTH WEST REGION



METEOROLOGICAL STATIONS

1. Gacan Libax
2. Gore
3. Tog Wajale
4. Boorama
5. Ijaara
6. Hargeysa
7. Gebiley
8. Hololka
9. Aburiin
10. Mandheera
11. Arabsiyo
12. Hadadle
13. Bown
14. Lafaruug
15. Bihendula
16. Ceel Gaal
17. Seylac
18. Berbera
a. Doboweyne
b. El Hume
c. Odweyna

1.6 AGRICULTURE

Agriculture is extensively examined in the Technical Report No 7 of the present study.

As a summary, the total farmland in the project area were estimated at about 71 000 ha in 1980, of which only 35% were currently under cultivation:

- The irrigated land, which is generally organised in enclosed gardens, covers a total area of 1965 ha, 59% of which are being prepared for future cultivation or left fallow.

- Rainfed agriculture, which has led to the clearing of large areas of former woodland, represents a farm area of 68 700 ha, of which 23 650 ha are cultivated, mostly with maize and sorghum.

These crops allow for a production of stokes and straws estimated at about 130 000 t of dry matter/year, mostly for livestock feeding.

The fallow land is also currently pastured by the herds.

1.7 WATER RESOURCES

The following is only a brief general survey of water use in the North-West, the full technical data being contained in reports 3 and 4 of the present study.

Water resources are obtained from three sources:

Sub surface water body
The deep aquifer
Storage of runoff

a) The sub surface water body

This is the water table situated between 1 and 6 m below the surface of the temporary rivers (toggas). Wells are generally dug by hand in the river bed (to water the animals) or on protected banks (especially when water is pumped mechanically to irrigate gardens).

In certain places, there is not even any need to dig wells as there are resurgences and continuous flow in the river. This is so in the case of the togga Durdur, where, at the end of the dry season, there was 40 l/s discharge at Qabri Baxar. This is also the case with the togga Waheen at Biyo Dai and at the point where it leaves the gorges (discharge of about 10 l/s).

b) The deep aquifer

There is very little exploitation of the deep aquifer in the North-West region, this being limited to some wells which supply Hargeysa with drinking water, and to dispersed wells used for watering livestock. The reason why the deep aquifer is so little used is due to the fact that it is generally far below the surface and sometimes saline. In the plateau area, it is at more than 100 m at Wajale, and more than 250 m at Qool Cadday. In the coastal plain, while it is at less than 4 m at Lughaye, it is at more than 70 m towards Kalowle, Karuure and Ceel Gaal.

c) Storage of runoff

Runoff is stored in two ways:

Stock ponds: this system can be observed in the plateau area, between the Hargeysa-Boorama road and the frontier, on the route which is used by many animals coming from Ethiopia;

Cement tanks: a number of these can be seen on the plateau to the South of Hargeysa, near Xadig-Xadig. They have a capacity of about 50 m3 and are used to supply both humans and animals.

1.8 CHARCOAL AND DRY-WOOD PRODUCTION

There are very few other activities, apart from tree cutting for building. There has been a noticeable disappearance of large trees around Hargeysa for quite some time. However, other settlement centres have been responsible for considerable damage to the environment, as wood has been removed to cook food and construct huts. This is particularly true in the case of the refugee camps and their immediate environment (Agabar, Laasdhuure). Within the space of a few months, shrubs and bushes within a radius of more than 1 km of the camps disappeared.

The North-West, unlike the North-East, does not produce incense from Boswellia sp.

Several rapid surveys carried out in the North-West made it possible to define the average cooking requirements of a family of 6 to 8 people:

Charcoal: one sack a month. One sack weighs about 25 kg (0.15 m3 with a density of 18 kg/hectolitre). Annual requirements thus amount to about 300 kg.

Average consumption in Africa is between 1 and 1.5 m3 of wood per person per annum or 8 m3 per annum for a family of 8 people, which represents about 1.5 tonnes of dry wood per annum.

Taking into account the fact that natural wood production on the plateau is just a little more than 2 tonnes/ha, it can be estimated that a family of 8 people requires approximately 0.75 ha per annum.

Although kerosine is often used for cooking in the larger towns, wood and charcoal are also widely used as a result of the policy of cutting down consumption of oil-based fuel, and they constitute the basic form of fuel in the rural centres and refugee camps. The only solution to the problem of deforestation is either to make wider use of oil-based products, or to create artificial plantations. In view of the climatic conditions, it is only possible to envisage irrigated plantations, with short-cycle species, such as Eucalyptus. Tests have already been carried out in the region with Eucalyptus gomphocephala and Eucalyptus camaldulensis, and good results obtained. The latter of the two proved to be the better, on non-limestone soils (in areas with limestone soils, this can profitably be replaced by Eucalyptus microtheca).

Rapid production (5 to 8 years) may be hoped for, reaching about 15 m3/ha/year, ie. about 10 tonnes/ha/year, to be marketed either in the form of charcoal or as wood. The choice is not always easy to make, as, even though charcoal costs five times as much to produce, the cost of transporting it is much less (since it is estimated that 4 tonnes of wood are necessary to produce 1 tonne of charcoal). It would therefore be advisable to install plantations of this kind near to the urban centres in order to reduce the costs of transporting the wood. According to studies carried out in East Africa (Earl, 1970), the net production costs (production + transport) make it worthwhile to use charcoal when the transport distances involved are more than 80 km.

Leaving aside these classic types of plantation, which require extra water from irrigation and which are only justified close to large urban centres, many small schemes can be implemented along the toggas, on the lowest of the alluvial terraces, where quick-growing trees are sure to find a subsurface water body. Reafforestation may be envisaged with Conocarpus lancifolius, which is widespread in the north east of the country.

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Chapter 2

METHODOLOGY

2.1 ECOLOGICAL ANALYSIS: PRINCIPLE OF THE METHOD

The ecological analysis here applied to the integrated development of a given natural area, deals with and defines the following points:

- The type and present condition of renewable natural resources:
- The productivity potential of the various milieux, defined by assessing the production capacity of the natural or cultivated vegetation;

The first phase is strictly qualitative and forms what might be called the ecological study of the North West region. The study leads a breakdown of the environment into various units, with the main ecological conditions (soil, climate, vegetation), which vary from one unit to another, being sufficiently constant in all the areas within the same unit. It results in a vegetation mapping of the project area.

The second phase is a quantitative study of the natural environment and corresponds to a production analysis. This part of the study enables assessment of the production of vegetation within each ecological system, and definition of its livestock carrying capacity, the quality of fodder and the tolerance threshold with respect to human activities.

The aim is to provide a technical basis for the range management measures which may be undertaken. The study is based on available documents, reports consulted in the various authorities' archives, topographical maps, aerial photographs and satellite photographs (a list is given in Appendix 1 - Bibliography).

2.2 QUALITATIVE APPROACH

2.2.1 CHOICE OF UNITS - DEFINITIONS

The basic unit in ecological analysis is the ecosystem. This is a complex functional system whose main interconnected variables are the climate, soil, topography, hydrology, vegetation, fauna and human influence.

Interactions between the biotic and abiotic factors within and between the various systems are far too complex to be dealt with rapidly and from an overall standpoint. It is for this reason that ecosystems are usually studied via vegetation. For the present, the vegetation and geomorphology are the best environmental indicators.

It is easily accessible to the observer and the least variation can be linked to a variation in at least one ecological factor.

Thus, within any given ecosystem, all the interacting ecological factors are seen in terms of a specific type of vegetation which may be termed a "community" or "group". Each ecosystem will thus be defined by the name of its vegetation group (which is itself usually defined by the one or more characteristic species, which sometimes dominate(s). An example would thus be the Panicum turgidum ecosystem. The first step in ecological analysis is thus to define the main groups of vegetation and to establish for each of these the main ecological characteristics which might concern any regional development project.

In certain areas, human activity has considerably modified the plant cover, either as a result of land clearing for agricultural development, or by over-grazing, as is often the case in the areas around townships. In these circumstances, it is best to refer to "potential vegetation", ie. the vegetation which would develop if human activity stopped. Thus, the cultivated areas on the plateau will be considered as zones in the Acacia etbaica or Acacia bussei ecosystems, during the ecological stage of the study. These cultivated or over-grazed zones will of course be taken into account during the quantitative stage of the study.

2.2.2 FIELD OBSERVATIONS

The enclosed 1:1 200 000 map shows all the areas actually visited. During these field trips, continuous observations were made along ecological transects. Observations included description of the vegetation, plant cover, and the main ecological factors - altitude, gradients, exposure, type of substratum, detectable human influence.

Plant species which were not immediately identifiable were collected, dried and identified at Hargeysa with the help of the botanical works quoted in the bibliography to this report.

2.2.3 ECOLOGICAL MAPPING

The ecological map of the North West region was drawn up to a scale of 1:100 000 on the basis of the 1976 topographical maps. There are more than 23 families of plants in the zone as a whole, which represents an area of more than 30 000 km2.

The main ecosystems defined were represented by 32 cartographic units, grouped into five bioclimatic zones.

All the various stages in preparation of the ecological map (design, drawing, plotting) made use of the 1:100 000 scale; only the printed edition of the map is to the scale of 1:500 000.

The legend indicates the following:

- Code for the ecosystem;
- Bioclimatic zone to which the ecosystem belongs;
- The general type of vegetation;
- The representative plant community;
- The main characteristics of the soil;
- The range of altitude observed;
- Average annual precipitation.

2.3 QUANTITATIVE APPROACH: PRODUCTION ANALYSIS

2.3.1 AIMS - METHOD - DEFINITIONS

This stage of the study has two aims: to assess plant production and to estimate the potential livestock carrying capacity of each ecosystem.

2.3.1.1 Plant production

The aim here is to assess the productivity of a given ecosystem with regard to the edible plant matter. Several factors are involved:

1) The palatability of the plants. The amount of production measured concerns those plants which are consumed by the livestock.

2) The water content of the green plants. This measurement makes possible to assess the production of a given pasture in terms of dry matter. The dry matter, which contains the nutritional substances, is measured after drying a green sample.

3) The amount of material which can actually be used. It is obvious that only part of the total estimated pasture production (or potential production) can actually be used. With this limit, it is possible to optimise pasture use, without there being any danger of rapidly and irreversibly damaging the environment (which is the case when land is over-grazed). However, the limit are not the same for the herbaceous plants, shrubs and trees (see § 2.3.4.2.

2.3.1.2 Livestock carrying capacity of the pastures

The livestock carrying capacity of a particular pasture is the number of animals which can be fed over a determined period on an unit area of the pasture under consideration. This concept is thus the result of a balance between the consumable production and the actual consumption the animals.

As food requirements vary considerably from one type of animal to another, various units have been defined so that the results can be mutually compared.

2.3.2 THE LIVESTOCK UNIT (L.U.)

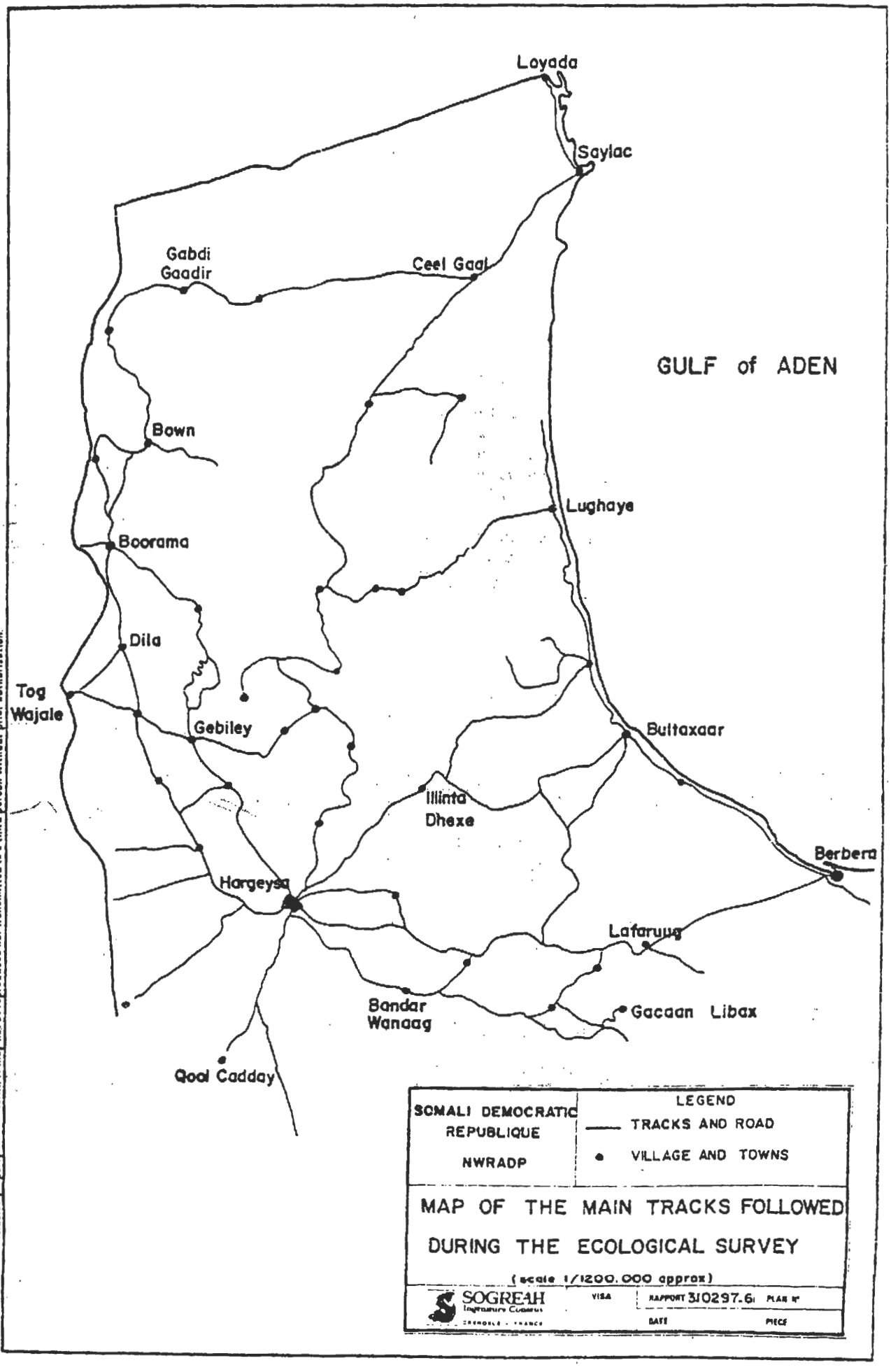
2.3.2.1 Definition

For the purposes of this study, the unit most commonly found in the litterature, the livestock unit (L.U.) was used. This corresponds to an animal weighing 250 kg (live weight), consuming 6.25 kg of dry matter a day.

In later calculations, the average weight for each species is expressed in terms of L.U.

2.3.2.2 Weight of the animals

In order to determine the food requirements of each type of animals, it is necessary to know the average weight of the animals. This is determined according to the average live weight as a function of age, and the distribution of age groups within the various herds.



By referring to the various sources, surveys and weighing operations carried out in the area, the following specific average live weights were obtained for each of the species found in the North West:

MEAN LIVE WEIGHT (in kg) AND CORRELATION WITH LU		
	Mean live weight (kg)	LU
Sheep	20	0.08
Goats	20	0.08
Camels	325	1.30
Cattle	175	0.70
Donkeys	100	0.40

2.3.3 FIELD MEASUREMENTS OF PRODUCTIVITY

The plot chosen must be homogeneous and perfectly representative of the ecosystem under consideration. In general, for an agrostological study, only the herbaceous layer is studied. However, in the North West region, the herbaceous layer is often poor, but on the contrary steppe-type vegetation which is of little use for cattle, offers a great potential for the smaller livestock and camels. It is for this reason that this study examines the herbaceous, shrub and tree layers.

2.3.3.1 Herbaceous layer

Double measurements were taken in each of the plots studied :

- A qualitative sample, by noting the species present every 10 cm along a 10 m strip ;

- Collection, at the same place, of all readily eaten species over an area of 4 m2. These plants are then weighed (fresh weight), left to dry for at least a week and then reweighed; in this way it is possible to obtain the weight of dry matter relative to the plot under consideration. The ratio between these two figures gives the water content expressed as a percentage of the fresh weight.

2.3.3.2 Shrub and tree layer

Ponderal measurements of leaf production were not carried out in each of the plots, but on a collection of standard trees and shrubs commonly found in the study area:

- bushy Acacias (A. edgeworthii, spirocarpa, horrida, mellifera, asak, etc.);
- Acacia etbaica and Acacia bussei;
- Commiphora sp;
- Balanites orbicularis;
- Grewia, Cadaba.

The leaf biomass of the ecological units was evaluated on the basis of the leaf measurements (leaves collected over a 1 m2 area and a height of about 1,5 m) expressed in grams of dry matter per m2. Two criteria were taken into account:

- The proportion of the various shrubs observed in the area;
- The average cover of the shrub layer in each cartographic unit, estimated from aerial photographs.

2.3.4 INTERPRETATION OF RESULTS

2.3.4.1 Definitions

Exact definitions are given below of the terms which will be used during the study.

Carrying capacity

This is the estimate number of head of livestock (expressed in L.U.) that a pasture land can feed without there being any deterioration or reduction in the life of the pasture. It is expressed in ha/L.U. or L.U/km2.

On the basis of this definition, for each ecosystem studied, the carrying capacity will also be given for each species and expressed in terms of an average number of ha/head/year. This will be called the specific carrying capacity (SCC).

2.3.4.2 Fodder production

Seasonal and annual fodder production

Climatic factors, which vary strongly from one year to another and one zone to another, have a combined action on annual and seasonal plant production. Due to the prolonged dry period in 1980, it was not possible to estimate the seasonal production accurately. The approach adopted involved using coefficients for the various factors, thus enabling the plant production for the whole year to be calculated.

On the basis of observations carried out in the area and the methods generally used in regions with a similar climate, ie. two rainy seasons, the new herbaceous growth observed is multiplied by 2 and new shrub growth, which is less significant during the second rainy season, is multiplied by 1.5.

Consumable fodder production

As has already been stated, the total green plant production of a particular pasture is not all consumable, for various reasons, amongst which are the following:

- Biomass losses during the dry season;
- Losses through plants being trampled;
- Inter seasonal variability;
- Necessity of maintaining a covering over the soil (protection against erosion and regeneration of the pasture the following year).

According to different sources*, only 1/3 to 2/3 of the gross vegetal production can actually be consumed by the animals. In the North West Region, depending on the type of plant cover, it is estimated that:

- 50% of the potential of the herbaceous layer can be exploited, as it is of poor quality;
- only 40% of the potential production of the tree and shrub layer can be exploited, given the density, thickness and height of the various species found.

2.3.4.3 Varying feed rations

It is not sufficient simply to know the weight of the animals and the potential productivity of the pasture in order to define in a realistic manner the possible carrying capacity according to the type of animal.

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* "National Hanbook for Range and Related Grazing Lands" - US Department of Agriculture, Soil Conservation Service. SCS Range 7-67, 1967.
Manuel sur les pâturages tropicaux - IEMVT - Ministère de la Coopération - 1978

The use of the various plant layers varies in proportion very much fro one type of animal to another. The following table illustrates these differences in the specific feed rations:

Table 2.3(2)

	Plant layers	
	Herbaceous plants	Shrubs and trees (up to 2 m)
Cattle	0.9	0.1
Sheep	0.7	0.3
Goats	0.4	0.6
Camels	0.3	0.7
Donkeys	0.4	0.6

Unit: fraction of feed ration

Source: N.R.A. Technical notes No 2 - January 1980

It is quite obvious that in range land where there are few herbaceous plants, but a large amount of thorn bushes, the food potential varies considerably between camels and cattle. Range of this type is far more severely limited, due to the lack of herbaceous plants, for cattle than for camels.

For this reason, in calculating the specific carrying capacity of the various types of grazing land, the following points were considered:

In the case of cattle, only the herbaceous layer was taken into account;

In the case of sheep, the herbaceous layer, which represents 70% of the feed ration, was assumed to be a limiting factor when accounting for less than 40% of the net usable production;

In the case of the camels and goats, all the shrub and tree cover (up to 2 m) is taken into account as well as the herbaceous layer.

2.3.5 RANGE PRODUCTIVITY MAP: CARRYING CAPACITY

The range land is mapped on the basis of the ecosystems defined on the ecological map. For each pasture, a classification factor of 1 to 5 is allocated on the basis of the carrying capacity in ha/LU.

The carrying capacity is defined on the basis of the plant production in the range, expressed in kg of dry matter per ha. On the map, this is shown in ha/LU/year.

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Chapter 3

RESULTS

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3.1 PERFORMANCE OF THE STUDY

3.1.1 METHODOLOGY

a) Herbaceous layer

On average, samples were taken from four 4 m2 plots in each of the vegetation units. Only the palatable herbaceous species were sampled. The samples were weighed when still fresh, and then left to dry in the sun for at least a week, and then reweighed.

The results given for each of the vegetation units are the weighted results of the measurements carried out in the plots and the average cover values for each unit.

b) Shrub and tree layer

Measurements were carried out on the main fodder trees and shrubs (see 2.3.3.2). The productivity was evaluated on the basis of the average cover provided by the canopy over the entire vegetation unit. The cover was estimated with the aid of 1:30 000 aerial photographs.

3.1.2 CONSTRAINTS

The whole of the study was carried out in 1980, a year during which the dry season lasted till May and June, thus only allowing for one observation period.

Thus, 1980 is not ideally representative of the climate as can be seen from the following table.

Table 3.1(1)

PRECIPITATION*			
Station	Average year	1980	% reduction with respect to a normal year
Hargeysa	418	315	25
Gebiley	429	372	15
Boorama	503	370	27
Bown	292	208	29
Cabdi	245	113	54
Ceel Gaal	51	32	47

* All the figures cover the period January - October, which is when observations were made.

From these results, it appears that the reduction in rainfall between January and October was proportionally greater in the coastal plain (about 50%) than on the plateau (25%).

In the present state of knowledge, it is not however possible to determine any relation at all between a variation in rainfall and the resultant variation in range fodder production which might correct the discrepancies observed.

3.1.3 RESULTS

The results correspond to the following calculations, which are explained in chapter 2:

- In the case of the herbaceous layer: 50% of the total production;
- In the case of the ligneous layer: 40% of the total production.

In the case of the coastal plain and subcoastal zone (bioclimatic zones 1 and 2), only one new growth per annum is considered. In the case of the other zones, 2 new growths per annum are considered. The results are thus multiplied by 2 (herbaceous layer) and 1.5 (shrub layer), as the second growth is less important than the first.

The net usable productivity (Pp) represents the annual quantity of dry matter available for livestock without there being any danger of the range being damaged.

The results of the ecological study and agrostological study will be presented simultaneously for each of the 31 ecosystems defined, in order to give a comprehensive picture. All the results of the agrostological study appear in the form of a table similar to the one below:

Plf	Pld	W	T_p	P_p	CLU	SCC			
						Sh	Go	Ca	Ce

Legend

Plf = Experimental plot; fresh weight in g/m2
Pld = Experimental plot; dry weight in g/m2
W = Water content in % of fresh weight
T_p = Total productivity in kg DM/ha/year
P_p = Net usable productivity in kg DM/ha/year
CLU = Carrying capacity in ha/LU/year

Upper line: Herbaceous layer
Lower line: Trees and shrubs layer

SCC = Specific carrying capacity (in ha/head/year) for
Sh = Sheep
Go = Goats
Ca = Camels
Ce = Cattle

3.2 PLANT COMMUNITIES

3.2.1 BIOCLIMATIC ZONE N°1: COASTAL PLAIN

This plain, whose altitude ranges between 0 and about 350 m, varies considerably in width, from 80 km near Saylac to 20 km near Berbera, to only 1 km to the East of Berbera.

The plain consits of Quaternary alluvium formed by sandy deposits of continental or marine origin, and varying in thickness. These horizons are sometimes situated on silty-clay horizons, or covered by silts deposited by the heaviest floods of the rivers which cross the plain. Climatic conditions are very severe: annual precipitation does not exceed 150 mm and rain falls only during the winter period. Average monthly temperatures range from 35.3° in summer (with maximum temperatures of over 40°) to 25.5° in winter. For most of the summer period, the kharif, which blows from the South-West, reduces relative humidity in the air to less than 50%.

Ten ecosystems can be distinguished in the plain:

- 4 halophytic ecosystems (CH1 to CH4) situated close to the sea;
- 4 typical ecosystems (CT1 to CT4);
- 2 subriverine ecosystems (CR1 and CR2).

The plain covers a total of 9400 km2, ie. 28% of the area studied.

3.2.1.1 Halophytic communities

CH1 - Suaeda monoica and Aeluropus lagopoides

This community ranges between 0 m and 20 m above sea level, spreading along the coast and in the flood spreading areas close to the sea.

Vegetation:

Suaeda monoica
Aeluropus lagopoides
Sporobolus spicatus
Odyssea mucronata
Sesuvium sesuvioides (abundant at Lughaye)
Cyperus conglomeratus } where the salt content is not too high
Salsola foetida }

Suaeda grows on hillocks, while Aeluropes thrives in the saltiest depressions. Depending on the location, Suaeda covers between 10% and 60% of the ground, with an average of 40%. This ecosystem covers a total of 76 200 ha.

Suaeda monoica is the dominant species of this community. It is a bush which can reach 2 m in height, with small leaves which are succulent and salty. The species is hardly cropped except by camels. It has a fodder value of 0.85 FU with 170 g of digestible nitrogenous substances per kg of DM (DNS).

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
- 603	- 140	- 76.8	- 1 400	700	3.3	-	-	4.2	-

CH2 - Aeluropus lagopoides

This ecosystem occurs mainly in flat areas which receive flood water and where there is poor drainage (little or no slope, superficial saline aquifer). This species is the only one to thrive in highly saline areas, and in places the cover may reach as much as 20 - 30%, with an average value of 10%.

The soil is of fine texture, overlying horizons which are in general sandy.

Aeluropus is a perennial creeping grass which is chiefly cropped by camels (and occasionally by sheep). It has a nutritional value of 0.5 FU/kg DM with 30 kg DNS/kg DM.

This ecosystem covers a total area of 3180 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
12.8	8.2	36	80	40	57	4.6	4.6	74.1	-
-	-	-	-						

CH3 - Salty ponds without vegetation

This is not a complete ecosystem, but a biotope where the extremely saline conditions exclude the growth of any vegetation.

These areas are generally located behind the string of dunes, where it is impossible for runoff to disperse and where drainage is non-existent due to the superficial saline water table.

When heavy floods occur, water and silt is trapped, forming temporary pools where the water gradually evaporates, leaving behind a cracked and saline clayey crust. Areas of this kind are to be found at the foot of Mount Elmis (Ceel Shikh) and to the West of Lughaye, covering an area 40 km long and 1 to 4 km wide.

These salty ponds cover a total area of 10 100 ha, which are totally non-productive.

CH4 - Avicennia marina mangrove swamps

Some remnants of mangrove swamps (Avicenia marina) exist in the estuaries of the major toggas between Saylac and Lawaada. The total area covered is only a few dozen hectares.

3.2.1.2 Typical communities

The ecosystems which are considered to be "typical" are not under the influence of any extreme ecological factor (such as salinity, gypsum, etc.) but directly reflect the climate of the region. Any differences are linked essentially with local variations in the soil or to greater or lesser amounts of moisture. They are distinguishable one from another by the presence of characteristic species, but the flora as a whole is substantially the same.

Rainfall varies from 50 to 150 mm, occuring in the form of localised storms which measure a few kilometres across. It is thus clear that certain places will only be watered every two or three years. However, from the month of September onwards, the monsoon winds change direction, bringing about an increase in the relative humidity and a

CT2 - Panicum turgidum - Balanites orbicularis open woodland

In certain parts of the coastal plain, above the Panicum turgidum community there occurs a tree and shrub layer dominated by Balanites orbicularis. In view of the extreme climatic characteristics in the coastal plain, the presence of these trees and shrubs can only be due to the existence of clays and silt with good water-retaining capacities situated not far below the sandy surface horizons.

In certain places, the trees receive water from ill-defined flow paths when floods occur on the major rivers. This is the case at Bullaxaar.

The herbaceous layer is essentially the same as that described in the previous section (CT1) but in addition, where there is runoff, the following occur:

Cenchrus ciliaris
Cyperus conglomeratus
Aerva persica
Jatropha glandulosa
Solanum somalense

The ligneous layer consist of:

Balanites orbicularis
Maerua somalensis
Cadaba glandulosa
Dobera glabra

The herbaceous layer still covers between 5 and 15% of the area, while the tree and shrub layers account for between less than 1% and 10% of the cover, averaging 2%.

This ecosystem covers a total area of 209 240 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
39 13.4	18 7.5	54 44	180 75	120	19	1.5	1.5	24.7	-

CT3 - Acacia spirocarpa open shrub

This sub-desert scrub occurs on the consolidated sandy soils of the coastal plain and is situated essentially in the higher part close to the first of the escarpments.

Acacia spirocarpa, which is characteristic of the ecosystem, is a low branching bush, less than 2 m in height. Panicum turgidum does not cur in this group and is replaced by species such as Lasiurius hirsutus and Cymbopogon schoenanthus. This ecosystem has very little

variety of plants, the main ones, in addition to those already mentioned, being:

Cadaba glandulosa
Indigofera ruspolii
Iphiona rotundifolia

The average plant cover is low. Acacia spirocarpa may reach 50%, but it has an average value of 20%. The herbaceous layer consists mainly of Indigofera ruspolii, which covers about 3 to 5%, probably due to the extended surface root system of Acacia spirocarpa.

Acacia spirocarpa has a nutritional value of 0.7 FU/kg DM (average value, common to green foliage of the Acacia genus) and 10 g DNS/kg DM. The herbaceous layer has the following characteristics:

- Lasiurius hirsutus (perennial): cropped especially by camels, this has a fodder value of 0.45 FU/kg DM and 50 g DNS/kg DM;
- Cymbopogon schoenanthus (perennial): 0.50 FU/kg DM and 50 g DNS/kg DM.

This ecosystem covers a total area of 231 200 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
15.0 2.8	6.6 16.2	56 42	60 160	94	24.3	1.9	1.9	31.5	-

CT4 - Acacia spirocarpa - Balanites orbicularis open woodland

In this case, ecosystem CT3 is enriched by a shrub layer dominated by Balanites orbicularis, generally stunted and in poor condition. This is the case in the area around Berbera. It may be estimated that Balanites orbicularis covers 1% of the area. The total area covered by this community is 61 200 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
12.0 32.7	5.3 18.9	56 42	50 190	101	22.6	5.1	1.8	29.4	-

3.2.1.3 Subriverine communities

Given the small extent of these ecosystems, they were not mapped. They are specialised communities occuring along the banks of toggas. The term "subriverine" is used here to underline the fact that these rivers are of temporary character.

According to the dimensions of the togga and the type of alluvium, two ecosystems may be observed:

CR1 - Tamarix nilotica

This is characteristic of the large toggas and well consolidated alluvium. Tamarix grows on both banks of the togga and can reach 5 to 7 m in height. The main species occuring with Tamarix, growing on banks which are sometimes flooded, are the following:

Cenchrus ciliaris
Dactyloctenium scindicum
Sporobolus spicatus
Calotropis procera (also in the togga bed)
Aerva javanica
Crotalaria deflexa
Heliotropium sp.
Dipterygium glaucum

Tamarix may cover as much as 80% of the area, averaging 40%. In general, the herbaceous layer cover is not very great (less than 5%). It may be estimated that this community covers a total area of several hundred hectares.

CR2 - Leptadenia pyrotechnica

The Leptadenia community is found along the banks of the smaller toggas and also on the banks of the larger ones, when there are considerable deposits of wind-borne sand on the banks (this is the case, for example, on the togga Waheen).

The main species accompanying Leptadenia are the same as those in CR1. The cover is low and only localised (10%).

While the production of green matter is much higher in those two ecosystems than in the others, they have a very small role in stock-breeding, due to the very small area covered by the communities (in all only a few hundred hectares), and to the presence of a large number of plants which are not cropped by the animals. Leptadenia is eaten, but not sought after, by goats and camels.

3.2.2 BIOCLIMATIC ZONE N° 2: SUBCOASTAL ZONE

This zone is situated between 350 m and 900 m altitude. It is characteristic of the alluvial and colluvial deposits situated in the upper part of the coastal plain, together with the first rocky and stony excarpments of the mountain range. Deposits from the end of the Tertiary were deeply eroded during the Pleistocene, but some formations were protected from erosion by lava flows, which today form large plateaus stretching between Daragodle and Agabar; in spite of its closeness to the sea, Mount Elmis has vegetation which is typical of the communities growing on basalt in the subcoastal zone.

Rainfall in the area as a whole varies from 150 mm to 250 mm per annum, and occurs essentially in the form of localised showers falling during the winter (Lafaruug, at an altitude of 705 m, receives an average of 230 mm of rain a year).

This subcoastal zone is an intermediate stage between the coastal plain and the Acacia zone. This means that in addition to some species which are characteristic of the zone (including the genus Commiphora), there is quite a wide range of flora, including certain species which are found in the coastal plain and others from the Acacia bussei open forest.

The soils are rough mineral soils to slightly developed and are more often than not highly scoured and eroded, as can be seen from the Hargeysa-Berbera road.

This zone has a more or less constant width, of about 25 to 30 km.

Seven ecosystems were distinguished in the zone:

- 3 typical ecosystems (ST1 to ST3) with Acacia and Commiphora;
- 2 edaphic ecosystems peculiar to the North-West (SE1 and SE2);
- 2 subriverine ecosystems (SR1 and SR2).

3.2.2.1 Typical communities

ST1 - Acacia horrida subsp. benadirensis - Commiphora sp.

This community occurs on the lowest of the rocky slopes and the stony hills of metamorphic character (psammites, schists, gneiss) or granitic character, situated between about 350 m and 900 m.

- Trees and shrubs

Commiphora sp.
Acacia asak
Acacia horrida subsp. benadirensis
Acacia somalensis
Acacia mellifera
Delonix elata
Balanites aegyptiaca

. Small shrubs

Grewia tenax
Jatropha spinosa
Turraea parvifolia
Cadaba glandulosa
Iphiona rotundifolia
Solanum sp.
Adenium obesum
Farsetia longisiliqua

. Herbaceous plants

Barleria acanthoides
Blepharis edulis
Indigofera ruspolii
Boerhavia elegans
Boerhavia repens
Caralluma sp.
Euphorbia triaculeata
Euphorbia longetuberculosa

. Grasses

Chrysopogon aucheri var. quinqueplumis
Cymbopogon schoenanthus

The main families in this community are the Mimoseae, Capparidaceae (Cadaba), Tiliaceae (Grewia) and Acanthaceae (Barleria, Blepharis).

The cover is very low. The herbaceous plants cover about 2% of the area, the woody layer varying between 5% and 30%, with an average value of 10%. The ecosystem covers a total area of 287 330 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
1.0 8.0	0.5 3.7	51 54	5 37	25	91.2	51.1	7.3	118.6	-

ST2 - Acacia edgeworthii/Acacia spirocarpa/Commiphora sp.

This community occurs on the consolidated and eroded sandy to gravelly alluvial an colluvial deposits. It resembles ecosystem CT3 in appearance, but is far richer in species.

. Trees and shrubs

Acacia edgeworthii
Acacia spirocarpa
Acacia nr. bussei
Commiphora sp.
Balanites aegyptica
Balanites orbicularis
Delonix elata
Premna resinosa

. Small bushes

Grewia tenax
Cadaba glandulosa
Cadaba farinosa
Iphionia rotundifolia
Croton cliffordii
Salsola forskalii
Caesalpinia erianthera
Jatropha spinosa
Tephrosia obbiadensis
Adenium obesum
Lycium europaeum

. Herbaceous plants

Indigofera ruspolii
Blepharis edulis
Barleria sp.
Hibiscus micranthus
Ceropegia sp.
Indigofera sp.

. Grasses

Eragrostis hararensis
Chrysopogon aucheri var. quinqueplumis
Lasiurius hirsutus
Sporobolus variegatus
Chloris myriostachya
Dignathia sp.
Enteropogon sp.
Sporobolus sp.

The cover provided by this group varies considerably, from 5% to 40% (as is the case at Shiikh Abdaal, to the North of Mandheera, where the higher rainfall results in a cover of almost 50%). An average value might be fixed at 15% with the shrubs covering about 10% and the trees 5%.

The total area covered by this ecosystem is 282 850 ha.

Two species have the following amounts of Digestible Nitrogenous Substances:

- Cadaba glandulosa (green leaves): 12.8 g/kg DM;
- Grewia tenax (green leaves): 10.9 g/kg DM.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
4.9 12.1	2.2 6.3	55 48	20 60	46	49.6	12.8	4	64.5	-

ST3 - Acacia - Commiphora xerophytic open scrub

This community is typical of the basalt plateaus situated between Agabar and Daragodle, and of the entire frontier region with Djibouti. The vegetation is very sparse, and in places even non-existent. The ground surface is pebbly and there is no soil, except perhaps in the very slight depressions where there are accumulations of finer material.

This community is distinguished by the fact that it contains no characteristic species, but is formed from the most xerophytic species of the previous ecosystems (ST1 and ST2).

Acacia asak
Acacia mellifera
Acacia somalensis
Rhigozum somalense
Capparis sp.
Indigofera sp.
Blepharis sp.
Barleria sp.
Salsola forskalii
Chrysopogon aucheri
Cymbopogon schoenanthus

The total cover varies from 0 to 20%, with the average situated around 5% (with 1% for the herbaceous plants and 4% for the trees and shrubs).

The total area covered by this community is 189 070 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
- 5.6	- 2.9	- 48	- 30	18	126.7	-	10.1	164.7	-

3.2.2.2 Edaphic communities

SE1 - Rhigozum somalense xerophytic ecosystem

This community, whose dominant ecological factor seems to be the substratum, occurs exclusively on basalt soils or glacis and on the limestone massifs between 60 and 800 m altitude.

This is the case with Mount Elmis, where this type of community was discovered for the first time, but is also true of all the rocky escarpments at the start of the mountain range near Qabri Baxar Kalaxle. Some of the species of ecosystem ST1 are also to be found.

. Shrubs

Acacia mellifera
Rhigozum somalense
Acacia tortilis
Delonix elata
Moringa aptera

. Low woody vegetation and herbaceous plants

Caesalpinia sp.
Convolvulum sericophyllus
Blepharis sp.
Sporobolus sp.
Iphiona rotundifolia
Cissus sp. (creeper)

Rhigozum is the dominant species of the community, which covers 20% of the area on average (13% for Rhigozum, 7% for the other species, essentially Acacia tortilis and Acacia mellifera). The ecosystem covers a total area of 52 730 ha.

Flf	Fld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
3.9 21.2	1.8 10.2	54 52	20 100	70	32.6	12.8	2.6	42.4	-

SE2 - Iphiona rotundifolia and Indigofera ruspolii

This ecosystem is governed by the type of soil. It is only found in certain places, on coarse-grained colluvial sands, originating from the limestone and sandstone massifs, near the togga Waheen, Waraqadhigta and near Shiikh Abdaal (on the Berbera road).

It has the aspect of a regular rangeland, with grasses 40 cm high, and where there are absolutely no shrubs. It consists of:

Iphiona rotundifolia
Indigofera ruspolii
Cadaba glandulosa
Adenium obesum

Depending on the area, either Iphionia or Indigofera dominates. Some authors consider that a community of this sort may be a sub-climax as a result of human activity (developed by over-grazing), but this assumption does not appear to be realistic, as it does not explain the very precise location of this community nor ites very clear limits which coincide with the type of soil.

This community covers about 25% of the ground, over an area of 43 650 ha in the study area.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
53.2 -	21.8 -	59 -	220 -	110	20.7	1.7	1.7	26.9	-

3.2.2.3 Subriverine communities

SR1 - Salvadora persica - Dobera glabra

This ecosystem corresponds to the Tamarix nilotica ecosystem (CR1) described in the coastal area. A characteristic example is to be found on the togga Durdur at Qabri Baxar, where this community covers about 2600 ha of sandy and gravelly alluvium. These zones, which are well watered, are in addition partly cultivated (cf. Agronomy report, n° 7).

This community covers much of the ground (50%, of which 40% is trees and 10% herbaceous plants), and consists of the following plants:

. Trees

Salvadora persica
Dobera glabra
Ziziphus mauritiana
Acacia tortilis
Lawsonia inermis
Tamarindus indica
Ficus sycomorus (rare)
Balanites orbicularis

The shrub and herbaceous layers (Sporobolus spicatus and Pennisetum dichotomum) are not very developed as a result of the considerable tree cover and marked over-grazing.

The trees and shrubs provide about 60% coverage, and the herbaceous plants 10%, ie. 60% on average.

The area covered by this community may be estimated at about 13 000 ha (8000 ha in the delta of the tcgga Waheen and 5000 ha spread throughout the study area).

Acacia tortilis is a tree whose foliage and fruit are eaten by the animals. It has a food value of 80 to 120 g DNS/kg DM (both for leaves and fruit). Near Xariirad, these trees provide additional feed for the livestock at the end of the dry season and are pruned into the shape of an umbrella. This quickly damages the trees and results in a number of them dying.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
- 250.0	- 107.5	- 57	- 1075	645	3.5	-	0.3	4.6	-

3.2.3 BIOCLIMATIC ZONE N° 3: ACACIA BUSSEI ZONE

In this zone, Acacia bussei is common to all the ecosystems. It develops best between 900 m and 1250 m altitude and forms the most extensive community in what formerly was Somaliland. The area covered by Acacia bussei woodland is estimated at 50 000 km2 (British Commonwealth Forest Conference, 1957).

The community, which is characteristic of the plateau region (within the altitude limits mentioned above) occurs essentially to the South of Hargeysa and, as a result, does not extend very far into the study zone, where it forms instead a very clearly defined vegetation stratum in certain places, situated immediately above the subcoastal zone.

The relevant climatic data indicate that rainfall is between 150 and 300 mm per annum, and temperatures reach an average annual maximum of between 27° and 33°C and an average minimum of between 12° and 19°C (Burao station, 1040 m).

In the North-West, the meteorological conditions characterising this community appear to be a little different. The zones where Acacia bussei occurs appear in fact to receive between 250 and 350 mm of rainfall per annum. This difference is certainly linked to the soils, which are perhaps more coarse grained in this area and therefore less able to retain water than the soils on the plateau near Burao.

In the North-West, Acacia bussei prefers to grow on thick, often sandy or limestone soils. In addition, the tree has a very particular root stucture. In 1951, Glover unearthed and sketched the root system of Acacia bussei at Haleya. This revealed that the roots of a tree

4 m high penetrate only 30 cm into the soil but stretch horizontally over an area 23.25 m in diameter! This phenomenon may be seen at Bandar Wanaag, for example, where the roots have often been uncovered by erosion. Being adapted in this way, the tree can rapidly make use of rain water, even in the case of a small shower.

However, this is also one of the weaknesses of the species. On the plateau, between Hargeysa and Burao, it is possible to see many dead trees still standing. Various explanations have been brought forward for this phenomenon, but the most likely is that of the combined action of over-grazing (which, by uncovering the soil increases runoff and makes the roots less and less efficient) and very long periods of drought (as in 1980) which kill off trees which are already in very poor health.

Seven ecosystems were distinguished in this bioclimatic zone:

- 3 typical ecosystems (AB1 - AB3);
- 4 soil-dependent ecosystems (AB4 - AB7).

3.2.3.1 Typical communities

AB1 - Acacia bussei open woodland

This is open woodland, dominated by Acacia bussei, within which the trees are sufficiently far apart for their root systems to play their full role.

Vegetation:

- Trees

  Acacia bussei
  Acacia tortilis
  Balanites glabra

- Shrub and bush undergrowth

  Acacia reficiens var. misera
  Grewia erythraea
  Solanum carense
  Ipomea cicatricosa
  Hibiscus somalensis
  Hibiscus sp.
  Boscia minimifolia
  Ocimum tomentosum
  Blepharispermum fruticosum
  Cadaba farinosa

. Herbaceous plants

Solanum obiadense
Lycium europaeum
Justicia sp.
Crotalaria dumosa
Triplotaxis somalensis
Chrysopogon aucheri var. quinqueplumis
Tetrapogon villosus
Sporobolus variegatus
Sporobolus marginatus
Aristida adscensionis
Cenchrus ciliaris

The tree cover does not exceed 25% at the best of times. In general it is 10%. The herbaceous plants constitute a very variable cover, of the order of about 20% in the areas where there is grazing. In this case, Sporobolus variegatus, a creeping, stoloniferous grass with a high resistance to grazing, largely dominates over Chrysopogon aucheri, which is an excellent fodder species, but has practically disappeared.

In those areas where there is a large amount of grazing, such as the land along the Hargeysa-Berbera road and on the Ogo plateau around Hargeysa, the cover may reach as much as 60%, but in this case, 50 or 55% consists of species which are not cropped by the animals, and whose growth is favoured by over-grazing:

Aloe rigens
Aloe percrassa
Aloe trichosantha
Sansevieria ehrenbergii
Hypoestes hildebrandtii
Cissus sp.
Cassia italica
Ipomea cicatricosa
Withania sp.
Lasiocorys argyrophylla

Ecosystem AB1 as a whole covers an area of 248 810 ha, of which 80 000 ha may be considered as over-grazed and 71 160 ha have a high-density cover (variant AB1D, occuring on deep, well-watered soils).

Productivity:

For AB1 (typical)

Plf	Pld	W	T_p	P_p	CLJ	SCC			
						SH	GO	CA	CE
38.6 62.0	16.2 29.8	58 52	160 300	340	6.7	0.5	0.5	8.7	9

For AB1D

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
38.6 104.1	16.2 50.0	58 52	160 500	460	4.9	0.8	0.4	6.4	-

For AB1 (over-grazed areas)

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
4.3 63.1	2 30.3	54 52	20 300	200	11.4	6.4	0.9	14.8	-

AB2 - Xerophytic ecosystem - Acacia bussei and Acacia senegal open scrub

This community has a similar aspect to that of the Acacia-*Commiphora* ecosystem of the subcoastal ecological zone (zone 2). It consists of open, shrub-type steppe and occurs in the lowest part of the Acacia bussei zone or on the most gravelly soils. In this case, Acacia bussei does not grow very high (less than 3 m) and is very sparse.

Vegetation:

- Trees and shrubs

  Acacia bussei
  Acacia unispinosa
  Acacia senegal
  Commiphora sp.
  Delonix elata
  Sterculia rivae

- Bushes

  Grewia tenax
  Grewia mollis
  Grewia schweinfurthii
  Commiphora sp.
  Sarcostemma vinimale
  Croton somalensis
  Euphorbia sp.

. Herbaceous plants

These are essentially succulents:

Aloe trichosantha
Sansevieria ehrenbergii
Caralluma speciosa
Caralluma sp.

. Other plants

Senecio sp.
Crotalaria sp.
Chrysopogon aucheri var. quinqueplumis
Solanum sp.

This ecosystem is well-developed on the numerous stony hill crests in the North-West, and covers a total area of 320 380 ha. The average cover is 15%, of which 2% is accounted for by the herbaceous plants.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
5.2 59.5	2.4 23.8	54 60	20 240	164	13.9	6.4	1.1	18.1	-

AB3 - Acacia bussei - Salsola forskalii xerophytic open woodland

This community is located on the plateau situated to the North-East of Hargeysa, between the town and the village of Illinta Dhexe. It would appear to be a community which is very close to the Acacia bussei open woodland (AB1), highly over-grazed and modified in addition by more severe xeric conditions than ecosystem AB2.

In fact, in addition to Acacia bussei, the second abundant species is Salsola forskalii, which is common to the Acacia-Commiphora communities of the subcoastal zone, and which seems to confirm the arid character of this community, even though its presence could also be linked to the fact that there is salt in the soil. The soil on the plateau as a whole consists of thick, compact sandy-silt alluvium.

There is very little diversity in the vegetation:

. Characteristic species

Acacia bussei
Salsola forskalii

. Shrubs

Grewia tenax
Grewia mollis
Cadaba sp.

Succulents

Aloe trichosantha
Sansevieria ehrenbergii

Herbaceous plants

Sporobolus marginatus

There is very low rate of cover: tree and shrub cover 10%, herbaceous plants cover 2%. The total area covered by this community is 46 780 ha.

Fl	Fd	Ps	Clu	SG	GO	CA	CE
2.4	1	54	10	169	20.9	12.83	1.7	27.2	
41.2	16.5	60	165						

3.2.3.2 Edaphic communities

AB4 - Acacia bussei - Acacia misera open scrub

This ecosystem seems to be linked with sandy depogits which originated from the Nubian sandstone and are situated along the Hargeysa road near Dhubbato and Aw Barkhadle.

The community is in the form of scrub consisting of bushy acacias and in places tree-like Acacia bussei, but these are always very sparse. Below the wind-blown sandy surface horizon, the soil is alluvial, sandy silt and very compact.

Vegetation:

Acacia bussei (not very abundant)
Acacia misera
Grewia erythraea
Indigofera sp.

and species characteristic of over-grazed land:

Hypoestes hildebrandtii
Cassia spt
Cynodon dactylon
Sporobolus marginatus
Aloe trichosantha

There is a very low level of cover: 10% for the trees and shrubs and 2% for the herbaceous plants. The community covers a total area of 15 680 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SE	GO	CA	CE
9.3 48.4	4.3 20.8	54 57	40 210	166	13.7	3.2	1.1	17.9	-

AB5 - Cenchrus ciliaris - Chrysopogon aucheri var. quinqueplumis open grassland

These communities, which are governed by the type of soil, form the grass land with the highest level of productivity in the North-West. The pastures occur in all the thalwegs which are capable of receiving runoff from their hydrographical basis.

The soils are silty sand to sandy clay, rich in fine particles brought down by runoff, and the amount of water available per annum is very much higher than the level of rainfall in the areas.

Some of the large valleys subject to flooding display this kind of vegetation. This is the case, for example, of the Xadig xadig valley, which is one of the centres where fodder is produced for livestock awaiting shipment from Berbera.

However, the range of vegetation is very limited, and consists of the following grasses:

Chrysopogon aucheri var. quinqueplumis
Cenchrus ciliaris
Paspalidum desertorum
Aristida adscensionis

Chrysopogon and Cenchrus are the two dominant species and the average cover is 50%. The ecosystem covers a total area of 18 250 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SE	GO	CA	CE
476.0 -	195.2 -	59 -	1950 -	1950	1.2	0.1	0.1	1.5	0.7

AB6 - "Vegetation arcs" with Sporobolus marginatus open grassland

This arrangement of the vegetation in the Horn of Africa in "arcs" was shown up in the first aerial photographs of the region. While the arcs are visible even on satellite photographs, they are difficult to make out at ground level.

They consist essentially of a series of arcs of vegetation (both shrubs and herbaceous plants) separated by barren areas of almost equal width.

Several authors, including Mac Fayden (1950), Gilliland (1952) and Hemming (1965) have described these arcs, but at the present time all the explanations proposed are only in the nature of hypotheses, and none is fully satisfactory from every point of view. However, the formation of these arcs appears to be linked with wind erosion and runoff phenomena.

According to Hemming, the arcs are the result of over-grazing, the effects of which have been increased by wind erosion. They collect the runoff caused by rain falling in the barren strips. This phenomenon would explain the presence in the vegetation arcs of the perennial grass Andropogon kelleri, which requires much more water than can be provided by local rainfall.

The soil consists of a reddish silty sand, which is characteristic of this part of the Haud. The main species found in the arcs are the following:

Acacia bussei
Acacia tortilis
Cadaba farinosa
Boscia minimifolia
Solanum somalense
Indigofera sp.
Chrysopogon aucheri
Andropogon kelleri
Hypoestes hildebrandtii
Aloe trichosantha

The vegetation is quite dense in the arcs and there is an average cover of 60%, but for the ecosystem as a whole, the cover does not exceed 30%.

In the barren strips, the soil is more or less held together by Sporobolus marginatus, which has a cover of less than 5%. The ecosystem as a whole covers 48 380 ha.

PLT	PLG	W	T_p	P_p	GLU	SCC			
						SH	GO	CA	CE
42.5 35.6	20.4 17.8	52 50	200 180	308	7.4	0.6	0.6	9.6	7.2

AB7 - Sporobolus marginatus open grassland

This community, which does not display a great variety of vegetation, occurs on the Nubian Sandstone deposits to the South of the Hargeysa-Berbera road, covering a soil that is identical to that in AB6. The vegetation is in the form of patches several metres across, which are separated by sandy areas eroded by the wind, the whole having the appearance of a plain consisting of small dunes about 50 to 80 cm high,

covered by Sporobolus marginatus. In certain places, the following shrubs also exist:

Acacia bussei
Cadaba farinosa
Aristida sp.

The ecosystem has a low coverage of 15% and the total area covered is 19 480 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
81.04 -	38.9 -	52 -	390 -	390	5.8	0.5	0.5	7.6	3.7

3.2.4 BIOCLIMATIC ZONE N° 4: ACACIA ETBAICA ZONE

The characteristic plant of this zone is Acacia etbaica, which grows best between 1250 m and 1500 m, where the rainfall is between 350 and 550 mm per annum on average.

It is in this bioclimatic zone that Hargeysa is situated, as well as the plateau beween Hargeysa and Boorama and the rocky escarpments over 1200 m in altitude (but not exceeding 1600 m).

Climatic conditions are more temperate than in the previous zones. The monthly temperature at Hargeysa varies between a maximum of 24°-31°C and a minimum of 14°-20°C. The average monthly relative humidity does not exceed 70% (in January) but it does not drop below 50%.

Mean annual rainfall is 450 mm. Showers also occur during the so-called dry season (winter).

The ecosystem is very widespread in the study area, covering very different soils, which are derived from both the basement complex (soils with a high level of sand), and from the plateau (limestone soils with fine particles from the Auradu series), or even on gypsum soils which are frequently found in the East of the country (Hemmings, 1966).

This illustrates the fact that this is a bioclimatic unit and not a soil-dependent unit. However, there is an exception in the case of the Tog Wajale plain, which is an edaphic climax of the Acacia etbaica zone. The very clayey, black soils have prevented the growth of trees and are covered simply by herbaceous plants.

The fact that there are moderate temperatures, good quality soils and reasonable amounts of rainfall means that this is the area where rainfed agriculture is most widely practised. At the present time, 68 700 ha are cleared of trees and partially under cultivation (23 650 ha only) leaving aside large areas of fallow land.

On the other hand, while there is a sufficiently high level of rainfall over the year, the rainfall study showed that falls are irregular, and a large amount of rainwater cannot be used by the cultivated crops.

It is for this reason that the tree layer which has developed consists essentially of Acacia etbaica, to the exclusion of all other deciduous trees: only an acacia can withstand a long period without water and take advantage of a shower to develop foliage at any time of the year.

Five ecosystems were distinguished in this zone:

- 3 typical ecosystems (AE1 - AE3);
- 1 edaphic ecosystem (AE3 - the Wajale plain);
- 1 subriverine ecosystem, which is common to the Acacia bussei zone (AR1).

3.2.4.1 Typical communities

AE1 - Acacia etbaica open woodland

This ecosystem is found in two different forms:

In the form of bushes no more than 3 or 4 m high, which is a subclimax resulting from human activity. Acacia etbaica can keep its leaves well into the dry season, and is thus repeatedly cut down by shepherds, causing new shoots to appear on the stump. This can be seen all along the Hargeysa-Arabsiyo-Boorama road.

In the form of an open woodland with a tree layer growing to more than 6 m above ground level; this vegetation, which is less affected by human activity, represents the climax of the ecosystem. This woodland covers most of the plateau situated between the frontier with Ethiopia and the old Hargeysa-Boorama road.

On the whole, the soils are predominantly sandy, except in the thalwegs and minor depressions, where the runoff brings down a larger amount of fine particles. It is these areas in particular which have been cultivated (sorghum, maize).

Vegetation:

- Trees and shrubs

Acacia etbaica
Balanites glabra
Cadaba farinosa
Maerua sessiliflora

. Bushes and succulents

Cadaba sp.
Euphorbia nubica
Aloe megalacantha

. Herbaceous plants

Chrysopogon aucheri var. quinqueplumis
Andropogon kelleri
Eragrostis aulacosperma
Cynodon dactylon
Tetrapogon villosus
Ipomea cicatricosa
Boerhavia reniformis
Conidia somalensis
Helichrysum somalense
Barleria sp.
Blepharis edulis
Hypoestes hildebrandtii

The effects of grazing can be seen everywhere: there is very little cover from herbaceous plants, and a large number of plants not eaten by the animals, such as Hypoestes hildebrandtii (which is always very abundant), Ipomoea cicatricosa, Aloe megalacantha (sometimes 60% of the cover consists of this plant) and Acanthaceae of various kinds.

The cover varies from 20% to 60%, with the average value of 35% observed on the aerial photographs (leaving aside the cultivated areas). Herbaceous plants do not account for more than 10% of the cover on average.

The ecosystem covers a total of 399 950 ha, of which 17 150 ha are cultivated.

Flf	Fld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
81.1 122.6	29.2 56.4	64 54	290 560	626	3.6	0.3	0.3	4.7	4.9

AE2 - Acacia etbaica open scrub

This is a xerophytic communitic, characteristic of the stony limestone hill crests which can be seen on the plateau and the sides of the mountains between 1250 and 1500 m.

In this case, Acacia etbaica does not exceed 3 m, and other species are rare.

The rocky hill crests form rainfall collection areas for the small thalwegs, which are cultivated because of their thicker, more finely grained soils.

Certain species from ecosystems at lower altitudes are sometimes present, underlining the fact that this is a xerophytic community:

Acacia bussei (shrub form)
Acacia unispinosa
Croton cliffordii
Grewia schweinfurthii

The other species are more or less the same as those in AE1, with, however, fewer herbaceous plants. Only the following are present to any great extent:

Chrysopogon aucheri
Ipomea cicatricosa
Barleria sp.
Hypoestes hildebrandtii
Aloe sp.
Acanthaceae of various kinds

It will be observed that a number of these species are indicative of animals grazing.

Certain species of the following ecological zone (evergreen scrub) which require the least water are to be found in the upper part of this community and along the paths taken by runoff. The most characteristic of these species, Dodonea viscosa can be observed along the Hargeysa-Arabsiyo-Gebiley road, for example.

This ecosystem covers a total of 317 370 ha, of which 6500 ha are cultivated. The cover is low: 20%, of which less than 5% is accounted for by the herbaceous plants.

Plf	Pld	W	T_P	P_P	CLU	SCC			
						SH	GO	CA	CE
16.4 78.3	5.9 36.0	64 54	60 360	276	8.3	2.1	0.7	10.7	23.9

AE3 - Acacia etbaica and Euphorbia grandis

This ecosystem occurs near Boorama and represents a transition zone with the evergreen zone.

Euphorbia grandis is indicative of the level of rainfall (which varies from about 500 to 550 mm) and of the soils: this species prefers non-limestone soils.

The vegetation is similar to that of ecosystem AE1, enriched by the presence of the following species from the evergreen scrub zone:

Dodonaea viscosa (in rocky areas)
Euphorbia grandis
Acokanthera schimperi (which does not grow on limestone soils).

As in the case of ecosystem AE1, the natural vegetation has been widely destroyed in order to make way for rainfed crops.

The community has an average cover of about 40%, of which 15% is accounted for by the herbaceous plants and 25% by the tree layer. The ecosystem covers a total area of 10 290 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
98.0 115.6	35.3 53.2	64 54	350 530	668	3.4	0.3	0.3	4.4	4.1

3.2.4.2 Edaphic community

E4 - Chrysopogon aucheri var. quinqueplumis grassland

This is the community which is characteristic of the Tog Wajale plain. This plain consists of thick (more than 3 m) alluvial deposits, with between 60% and 77% clay, and containing an appreciable proportion of Na^+ (1.9 to 2.2 me/100 g). The soils are also alkaline (pH 8) (from Hemming, 1966 and John Dickinson, UNHCR, 1980).

The vegetation is purely soil-dependent, which explains why there is not a single tree or bush in this ecosystem. This can also be observed on the edge of the plain, towards Kalabaydh, where, as one moves further from the centre of the plain, Acacia etbaica reappears gradually, and the trees become larger and larger as one rises above the mean altitude of the plain.

Vegetation:

Chrysopogon aucheri var. quinqueplumis
Cenchrus ciliaris
Aristida ascensionis
Eragrostis hararensis
Andropogon gayanus
Andropogon kelleri

Grazing land varies over the plain, both in cover and in composition. Part of the zone is cultivated, with a view to producing sorghum and

maize. The average cover is about 10% and 15% (with the exception of the cultivated areas) and the Wajale plain covers a total of 25 560 ha, 500 ha of which are cultivated.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
192.1 -	63.4 -	67 -	630	630	3.6	0.3	0.3	4.7	2.3

3.2.4.3 Subriverine community

AR1 - Acacia tortilis - Zyzyphus mauritiana open woodland

This community occurs on the narrow alluvial terraces of the main toggas in the whole Acacia zone. This ecosystem consists of a multitude of small combinations of plants, linked with local conditions (particle size distribution, geological origin of soil, temporary flooding, speed of current, etc).

In each case, the various combinations of plants are dominated by the ubiquitous Acacia tortilis, and Zizyphys mauritiana. The following species also occur:

Combretum sp.
Balanites glabra
Euphorbia nubica
Aloe abyssinica (or megalacantha)

. Main herbaceous plants

Abutilon ramosum
Acalypha fruticosa
Boerhavia diffusa
Verbena oficinalis
Crotalaria laxa
Leucas jamesi
Hypoestes hildebrandtii
Setaria verticillata
Panicum maximum
Cymbopogon sp.
Chloris virgata
Urochloa panicoides

This communities vary considerably in density, state of degradation, etc.

These are essentially places where, during the dry season, the animals can find some food. There is considerable umbrella-pruning of the trees, and this applies to Acacia tortilis as well as the other deciduous trees such as Combretum or Ziziphus.

The development of irrigated agriculture has also brought about the destruction of riverine vegetation on numerous alluvial terraces.

Because of its small size, this ecosystem has not been mapped. However, the entire covered may be estimated at 1000 ha. The plant cover varies from 30% to 70%.

3.2.5 BIOCLIMATIC ZONE N° 5: EVERGREEN FORMATION

The feature of this zone is that it is the most temperate of those described so far. In addition, the vegetation of the various ecosystems involved is distinguished by the dominance of evergreen species.

With the exception of EG1, the zone is situated at more than 1400 m and is found in certain very particular points in the North-West region, ie. the Gacan Libaax cliff, above Mandheera, the Libaaxley massif between Bown and Jidhi, the northern slope of the Illinta Dhexe plateau, and the Buuraha Dharable massif situated between Bown and Qoljeit.

The soils supporting the various ecosystems in the zone are of several types (developed soils, basalt scree, granite, limestone). Average annual rainfall varies from 550 mm to 650 mm and sometimes more . There are two meteorological stations in the region which make it possible tho check these figures: one is at Gacan Libaax (1660 m altitude, where 660 mm per annum were recorded according to Hemmings, 1966) and the other at Daloh (10°47, 47°17) which is situated outside the study area but which provides a reading of 725 mm per annum at an altitude of 2060 m.

Temperatures in the winter are very temperate, and there is an occasional frost at Daloh.

Three ecosystems were defined in this bioclimatic zone:

- Buxus hildebrandtii open scrub (EG1)

  Dodonaea viscosa and Acokanthera schimperi open scrub (EG2)

- Juniperus procera relic forest (EG3)

3.2.5.1 EG1 - Buxus hildebrandtii open scrub

There are two facies within this ecosystem:

Buxus/Acokanthera scrub on lava rocks

This facies is well developed on the nothern slope of the Illinta Dhexe basalt plateau. It descends down as far as 1000 m, where it comes into contact with the Acacia bussei open scrub (AB2) and rises as far as the northern crest of the plateau.

There is no meterorological station in the area, but it is certain that this slope receives more rainfall than might be supposed from its altitude, due to the form of the relief.

The slopes are quite abrupt, which means that vegetation benefits from less intense sunlight. All these factors tend to lower the altitude at which a particular level of vegetation is found.

Vegetation:

Trees and shrubs

Buxus hildebrandtii
Acokanthera schimperi (begins above 1100 m)
Acacia etbaica
Ficus populifolia
Ficus vasta
Maerua sphaerogyna
Grewia tembensis
Dracaena schizantha
Teclea pilosa
Euphorbia sp.
Kleinia sp.
Rhus natalensis
Cadia purpurea
Jasminum Steudneri
Azima tetracantha
Pavetta gardeniifolia
Taerenna graveolens

. Herbaceous plants

Selaginella rupestris
Commelina sp.
Crassula sp.

The community has a dense cover, which reaches 50% near Illinta Dhexe.

Buxus/Adenia open scrub facies

This community may be seen on the rocky slopes crossed by the track which leads from Mandheera to Gacan Libaax, above elevation 1100 m approximately, as well as on the limestone spurs of the Libaaxley chain.

This is a very open scrub, occurring on lithosols, and consists of a large number of deciduous plants and succulents.

Vegetation:

Buxus hildebrandtii
Adenia venenata
Mimusops kummel
Acokanthera schimperi var. ouabaio
Terminalia brownii
Dodonaea viscosa
Cadia purpurea
Dracaena schizantha
Commiphora sp.
Combretum tricanthum
Pappea capensis
Olea chrysophylla
Acacia etbaica
Grewia schweinfurthii
Croton sp.
Aloe sp.
Hypoestes hildebrandtii

This facies has a low cover which never exceeds 20%; The Buxus hildebrandtii ecosystem covers an area of 35 730 ha in the study area. The average cover may be estimated at 35% in the case of trees and shrubs and 5% in the case of the herbaceous plants. The community has very little to offer from the stock-breeding point of view, despite the relatively high level of plant production. Most of the species are not palatable for animals.

Pif	Pid	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
17.7 20.0	6.2 9.2	65 54	60 90	114	20.0	1.6	1.6	26.0	-

3.2.5.2 EG2 - Dodonaea viscosa - Acokanthera schimperi open scrub

This community is crossed between Qoljeit and Bown. This is a xerophytic community which occurs between altitudes of 1400 and 1600 m, essentially on limestone rocks.

The most abundant species is Dodonea viscosa (which is also the least demanding of all the evergreen species). In addition, there are a large number of plants in this community which are also present in ecosystem EG1, with the exception, however, of Buxus hildebrandtii:

Vegetation:

Dodonaea viscosa
Acokanthera schimperi
Acacia etbaica
Combretum tricanthum
Pappea capensis
Grewia schweinfurthii
Cadaba sp.
Aloe sp.
Caralluma sp.
Hypoestes hildebrandtii
Pennisetum villosum

This ecosystem has a very low average cover of 10%, and the total area covered is 30 540 ha.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
10.8 20.0	3.8 9.2	65 54	40 90	94	24.3	1.9	1.9	31.5	-

3.2.5.3 EG3 - Juniperus procera open degraded forest

This community occurs on the highest mountains of former Somaliland, and was without doubt much more widespread several centuries ago. Today, only very degraded, relic communities remain in two areas, both above 1600 m:

- The Libaaxley chain, where the relics are so limited that it is impossible to map them;
- At Gacan Libaax, where the western part of the cliff has a still thriving relic forest, which is today protected.

This forest is characterised by its wide variety of plant life and a tree layer reaching 8 to 10 m, and consisting of Juniperus procera, the juniper tree.

Rainfall is estimated at more than 650 mm per annum (the Gacan Libaax station gives an annual average of 660 mm over a five year period).

The Gacan Libaax forest is a relic of the "climatic" type, ie. its gradual decline and reduction seems to have had less to do with human activity than with a change in rainfall, as would appear to be indicated by many still standing dead trees and the poor condition of those trees which survive.

Butzer (1961) suggested that there had been a decline in annual rainfall of about 20 to 25% between the observations made from 1880 to 1910 and those made in 1960.

Finally, this type of forest exists in a very vigorous form in the Harar region of Ethiopia, where it can be found at an even later stage of development (Juniperus and Podocarpus community, Gillet, 1941) in places where the rainfall exceeds 800 mm per annum.

The soils are about 1 m thick, and rest on weathered limestone. They have a plastic sandy clay texture, are alkaline (pH = 8.5 in water 1:2.5) and have a variable nitrogen content (0;17% at the surface and 0.05% lower down).

Vegetation:

. Trees and shrubs

Juniperus procera
Sideroxylon gillettii
Olea africana
Euphorbia grandis
Ficus populifolia
Pistacia abyssinica
Gymnosporia sp.
Ziziphus mucronata
Jasminum Steudneri

. Bushes

Buxus hildebrandtii
Cadia purpurea
Heeria insignis
Lannea malifolia
Maerua sphaerogyna
Euclea sp.
Sageretia spiciflora

. Herbaceous plants

Psiadia arabica
Coleus albidus
Ephedra sp.
Eragrostis sp.
Chrysopogon aucheri var. quinqueplumis
Andropogon sp.
Cynodon dactylon
Pennisetum villosum

The herbaceous plant layer is well developed near Gacan Libaax, where the entire community is out of bounds to animals as a result of a soil protection project and Eucalyptus cultivation scheme undertaken by the National Range Agency a few years ago.

The average plant cover is 50%, with 40% for the tree and shrub layer, and 30% for the herbaceous layer. The forest represents 6250 ha in the study area.

Plf	Pld	W	T_p	P_p	CLU	SCC			
						SH	GO	CA	CE
(estimated)			1000	1000	2.3	0.2	0.2	2.9	1.4
-	-	-	-						

3.3 THE CULTIVATED AREAS

On the plateau, there are extensive areas of rainfed crops. Apart from the production of grain, both sorghum and maize straw are produced. It may be estimated that 23 650 ha are cultivated, 6500 ha of which are in ecosystem AE2 and 17 150 ha in ecosystem AE1.

The production of straw may be estimated at 4 tonnes/ha/year on average, both for maize and sorghum. The water content is generally of the order of 30% and losses of the order of 20%, giving a production of 1.6 tonnes of dry matter per hectare per annum, usable by animals.

3.4 GENERAL RESULTS OF THE ECOLOGICAL STUDY

All the results of the ecological study are set out in the table on the next page.

In the coastal plain, the vegetation is dominated by Panicum turgidum. According to Hemmings (1966), this species is evidence of over-grazing, yet it seems more likely that Panicum, which is very resistant to drought, is well adapted to conditions in the coastal plain and thus develops more easily in the absence of competing species. ✓

The low plant cover of the subcoastal zone appears completely logical given the low level of rainfall and the pebbly or gravelly nature of the soils in the zone. Several authors consider that the subcoastal zone shows signs of intense over-grazing, but this does not appear to be the case as there are very few species characteristic of over-grazed areas.

GENERAL RESULTS OF THE ECOLOGICAL STUDY

Table 3.4 (1)

Ecosystem	Bioclimatic area	Community type	Vegetal community	Altitude (m)	Rainfall (mm)	Soils	Area (ha)	Cover (%)	
								Grasses	Trees and shrubs
HB1	Coastal zone	Halophytic communities	Cusc. monica and Aeluropus lagopoides community	0 - 10	100 to 350	On littoral sand or in areas with bad drainage	76 000	-	40
HB2			Aeluropus lagopoides community	0 - 10		On fine deposits with bad drainage	3 330	10	-
HB3			Salty ponds without vegetation	0 - 10		Behind the littoral zone where drainage is impeded by dunes	10 000	-	-
PT1		Typical communities	Panicum turgidus open grassland	40 - 350		On active alluvial sand (wind-bloom deposits)	351 000	10	-
PT2			Panicum turgidus/Balanites orbicularis open woodland	30 - 350		On alluvial sands over clay	209 240	10	2
PT3			Acacia spirocarpa open shrub	20 - 350		On consolidated sands and on rocks near the sea	221 200	< 5	20
PT4			Acacia spirocarpa/Balanites orbicularis open woodland	30 - 350		On consolidated sands over clay or near water courses	51 200	< 5	20
PR1		Fabriverine communities	Tamarix nilotica community	0 to 350		On the sides and bed of big toggas	-	< 5	40
PR2			Leptadenia pyrotechnica community			On the sides of small toggas	-	5	10
ST1	Subdesertal zone	Typical communities (Acacia/Commiphora scrub type)	Acacia asak - Ac. horrida/ Commiphora sp. open shrub	350 - 900	100 to 350	Over rocks and rocky soils	287 330	2	10
ST2			Acacia edgeworthii - Ac. spirocarpa - Commiphora sp. open scrub	350 - 900		On consolidated sands and eroded soils	232 350	-	15
ST3			Acacia sp/Commiphora sp xerophilous scrub	700 to 900		On lava plateaux and lava flows	189 370	1	< 5
RT1		Edaphic communities	Rhigozum somalense xeropcytic community	50 to 800		On lava derived soils and rocks, on calcareous rocks	52 770	-	20
RT2			Iphiona scoundifolia/ Ladigesia sp Grassland community	350 to 900		On colluvial sands from nubian sandstone and limestone	43 350	25	-
RR1		Fluviverine communities	Salvadora persica/ Dobera glabra community	400 to 900		On loamy to sandy-loam terraces	8 000	10	40
RR2			Balanites orbicularis/ Acacia tortilis woodland	-		Everywhere on terraces along the toggas	13 000	10	50
AS1	Acacia bussei zone	Typical communities	Acacia bussei open woodland	900 to 1 250	350 to 550	On deep alluvial soils	177 950	20	10
AB1D			Acacia bussei dense woodland			On deep and wet alluvial soils	71 160	20	35
AB2			Acacia bussei/Acacia senegal xerophilous open scrub			On rocks and rocky slopes	320 380	2	10
AB3			Acacia bussei/Salsola forskalii xerophilous open woodland		Around 350	On sedimentary plateaux	46 780	2	10
AB4		Edaphic communities	Acacia bussei/Acacia mirera open scrub		250 to 350	On sand deposits from nubian sandstone	15 680	2	10
AB5			Cenchrus ciliaris/ Chrysopogon aucheri open grassland			In thalwegs and flooded valleys (sandy-loam soils)	18 250	50	-
AB6			Sporobolus marginatus/ Acacia bussei vegetation "tiras"			On red soils of the Sand plateaux	48 380	15	15
AB7			Sporobolus marginatus open grassland			On sandy soils over clay	19 480	15	-
AS1	Acacia ethaica zone	Typical communities	Acacia ethaica open woodland	1 250 to 1 500	250 to 550	On alluvial soils and sedimentary plateaux	399 950	< 10	35
AE2			Acacia ethaica open scrub			On rocky hills and mountain slopes	317 370	< 5	15
AE3			Acacia ethaica/ Euphorbia grandis transition scrub	1 100 to 1 500	Around 550	On well-developed soils of the plateaux	10 290	15	25
AE4		Edaphic community	Chrysopogon aucheri edaphic grassland	1 540	250 to 550	On the clayey soil of Wajale Plain	25 560	< 15	-
AR1	Common to the whole Acacia zone	Fabriverine community	Acacia tortilis/ Lycium shawianum open woodland			On the sides of toggas	-	-	-
EQ1	Evergreen Scrub forest zone	Typical communities	Juniperus procera Hochst. open scrub	1 000 to 1 500	550 to 650	On the north facing slopes of the Lava and basement complex mountains	15 730	5	15 to 50
EQ2			Dodonaea viscosa/ Acacanthera ecalsperi open scrub	1 400 to 1 500		On limestone mountains and rocky soils	10 540	-	10
EQ3			Juniperus procera relic forest	> 1 600	> 650	On well developed soils of highest mountains	6 250	30	40

The Acacia bussei and Acacia etbaica zones both show signs of over-grazing in places. The Acacia bussei zone is the most degraded in the north of Somalia, essentially to the south of Hargeysa. The herbaceous layer has almost totally disappeared, and there are large areas on the plateau where dead trees are to be found. In the Acacia etbaica zone, the degradation has followed a different pattern. The grass herbaceous layer has slowly been invaded by species which are not cropped by the animals, such as Hypoestes hildebrandtii or Aloe sp. and the tree and shrub layer has been considerably disturbed by human activity, which is most noticeable in this ecological stratum: excessive pruning at the start or in the middle of the dry season (Acacia etbaica keeps its leaves very late into the dry season), cutting of wood for fires or construction purposes (this was the case at the beginning of the century with Juniperus procera, on account of its straight trunk, which led to the virtual destruction of the forest), or quite simply land clearance with a view to developing the land for agricultural purposes.

The relationship between vegetation, precipitation and altitude is not altogether a strict one, as the relief has an overwhelming influence and creates zones where the high level of rainfall has nothing to do with the altitude, as is the case, for example, at Mandheera. However, it is clear that only the Acacia etbaica zone is fit for the development of rainfed agriculture. Given the limiting value of rainfall, which varies from 350 to 550 mm and is distributed very irregularly in time, only the thalwegs and the lower slopes, where rain water can be supplemented by runoff, can be considered as permanently cultivable areas.

The other zones have very little potential for agriculture, with the exception of irrigated agriculture and the development of palm groves along the coastal strip.

3.5 RANGE PRODUCTIVITY STUDY: SUMMARY AND REMARKS

3.5.1 RESULTS TABLES

The results of the agrostological study for each ecosystem are given in table 3.5.(1). The following table (3.5.(2) gives a summary of the productivity of each bioclimatic zone.

Table 3.5(1)

RESULTS OF THE AGROSTOLOGICAL STUDY

Ecosystem	Gross productivity (kg DM/ha)		Net usable productivity (kg DM/ha)	Specific carrying capacity (ha/head/year)					Total area (ha)	Total carrying capacity* (LU/year)
	Herbaceous layer	Tree and shrub layer		Total* (ha/LU)	Sheep	Goat	Camel	Cattle		
CH1	-	1 400	700	3.3	-	-	4.2	-	76 200	23 382
CH2	80	-	40	57	4.6	4.6	74.1	-	3 180	56
CT1	180	-	90	25.3	2.0	2.0	32.9	-	351 100	13 852
CT2	180	75	120	19.0	1.5	1.5	24.7	-	209 240	11 006
CT3	60	160	94	24.3	1.9	1.9	31.5	-	231 200	9 527
CT4	50	190	101	22.6	5.1	1.8	29.4	-	61 200	2 710
ST1	5	37	25	91.2	51.1	7.3	118.6	-	287 330	3 149
ST2	20	60	46	49.6	12.8	4.0	64.5	-	282 650	5 703
ST3	-	30	18	126.7	-	10.1	164.7	-	189 070	1 492
SE1	20	100	70	32.6	12.8	2.6	42.4	-	52 730	1 618
SE2	220	-	110	20.7	1.7	1.7	26.9	-	43 650	2 105
SR1	-	3 240	1 944	1.2	-	0.1	1.5	-	8 000	6 817
SR2	-	1 075	645	3.5	-	0.3	4.6	-	13 000	3 675
AB1	160	300	340	6.7	0.5	0.5	8.7	9.0	177 650	26 477
AB1D	160	500	460	4.9	0.8	0.4	6.4	-	71 160	14 349
AB1S**	20	300	200	11.4	6.4	0.9	14.8	-	-	-
AB2	20	240	164	13.9	6.4	1.1	18.1	-	320 380	23 032
AB3	10	165	109	20.9	12.8	1.7	27.2	-	46 780	2 235
AB4	40	210	166	13.7	3.2	1.1	17.9	-	15 680	1 141
AB5	1 950	-	1 950	1.2	0.1	0.1	1.5	0.7	18 250	15 600
AB6	200	180	308	7.4	0.6	0.6	9.6	7.2	48 380	6 532
AB7	390	-	390	5.9	0.5	0.5	7.6	3.7	19 480	3 330
AE1	290	560	626	3.6	0.3	0.3	4.7	4.9	382 800	106 330
AE2	60	360	276	8.3	2.1	0.7	10.7	23.9	310 870	37 611
AE3	350	530	668	3.4	0.3	0.3	4.4	4.1	10 290	3 013
AE4	630	-	630	3.6	0.3	0.3	4.7	2.3	25 560	7 259
EG1	60	90	114	20.0	1.6	1.6	26.0	-	35 730	1 785
EG2	40	90	94	24.3	1.9	1.9	31.5	-	30 540	1 258
EG3	1 000	-	1 000	2.3	0.2	0.2	2.9	1.4	6 250	2 740
Cultivated areas:										
. in AE1	2 000	-	1 600	1.4	0.1	0.1	1.8	1	17 150	12 250
. in AE2	2 000	-	1 600	1.4	0.1	0.1	1.8	1	6 500	4 643
TOTAL									3 352 200	

* Rounded off figures.

** Overgrazed facies.

Table 3.5 (2)

Bioclimatic zone	Total area (ha)	% of the studied area	Total carrying capicity (L.U/year) (1)	Carrying capacity (ha/L.U/year)
Coastal	932 120	27.8	60 530	15.4
Subcoastal	876 630	26.1	24 560	35.7
Acacia bussei	717 760	21.4	92 700	7.7
Acacia etbaica	729 520	21.8	152 930	4.8
Evergreen	72 520	2.2	5 780	12.5
Cultivated areas	23 650	0.7	16 900	1.4
Total area	3 352 200	100.0	353 400	9.5

(1) rounded off figures

According to these evaluations, it is estimated that the grazing land identified in the study area should enable an annual load of 352 920 LU to be maintained normally. Therefore the average carrying capacity of the range in the study area is 9.5 ha/LU/year or 10.5 LU/km2/year. However, for 1980, when there was a long dry period and a single rainy season, the carrying capacity of the range must be calculated from a series of observations made over a single rainy season. In this respect, the observations and survey carried out during the course of the study enable the load to be evaluated at 13.8 ha/LU in 1980.

This explains the fact that practically only family herds (ie. animals providing milk and used to draw equipment) were present during this period, even though they are more vulnerable to the effects of drought, while most of the migrating herds in the region were moved to the more watered regions of the Ogaden. The livestock study which complements the vegetation study should make it possible to check this hypothesis.

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Part 2

LIVESTOCK STUDY

Chapter 1

PASTORALISM AND LIVESTOCK PRODUCTION

1.1 PASTORALISM

1.1.1 PASTORAL COMMUNITIES

On Northern Somalia the pastoral activity is dominant, also being associated with food crop production on the better lands of the plateaus and with a major commercial activity for livestock products and other consumer goods.

The Somali were originally purely itinerant and nomadic people. Although some have settled and become involved in agriculture almost all are still much engaged in the practice of transhumance.

The organisation of the pastoral society and its rules is detailed in the related technical report N° 9. Population and demography, which reveals that pure nomadism is the life style of only about 6000 families ie 10% of the population residing in the Northwest. Altogether it was estimated that 145 000 people (16 600 families) one way or another have a pastoral activity.

1.1.2 RANGE ORGANISATION AND TRANSHUMANCE

1.1.2.1 Range use

Traditional right on the range directed the organisation of the pastoral communities and ensured their survival. Each clan or tribe occupied a "bel" or pastoral unit including migratory routes privately owned dry season water points associated to a rangeland managed on a collective basis. Sometimes there was also agricultural land.

These range lands, which the pastoralists would consider theirs, ofte crossed national frontiers. Reciprocal watering, and thus grazing rig were often subject to violent confrontations.

By a law passed on November 1st 1970, tribes were no longer recognise At the same time, the law revoked common land rights and private ownership of water holes. Nevertheless, these traditional patterns are still reflected in the present use of the range.

1.1.2.2 Transhumance

Though nomadism is no longer the dominant life style, the practice of transhumance is and will remain necessary in this semi-arid region of the Northwest often subject to irregular climatic conditions.

As a result, it would seem that most commonly only herdsmen and shepherds migrate with the herds. The other members of the family, together with the animals which provide food, remain in the camp (Degoua). However, camps are sometimes moved or secondary camps established in the migration areas. This is fairly rare in the case of groups engaged in commercial or agricultural activities.

Several documents* give indications on the transhumance patterns and the traditional migrating routes of the different pastoral communities staying in the project area. Nonetheless, these are subject to deep changes according to political circumstances, group rivalries, or climatic disturbancies.

Migrating movements would mostly tend to take place along a North South axis from the coastal plain to the highland range, according to the seasons and the rainfall regime. Sometimes transversal movements do occur In addition, there are also side movements which are specific to certain type of animals.

This reveals a very well planned and organised management of the range both throughout time and space.

As a result of the observations made on the movement of the main pastoral communities it can be seen that:

- The Issa, who breed mainly camels and small ruminants, would migrate along the Djibouti frontier in the coastal plain around Saylac, and in the mountainous region to the South-East of the Djibouti-Addis Abada railway, where they would appear to have some wells. The highland range which they pasture is not above 1000 m in altitude;

- The Gadabursi, based near Boorama, would seem to migrate between the Lughaya district (although they have no water holes in the coastal plain) and the plateau to the North of Jijiga in Ethiopia. Their main traditional pastures and water holes seem to be at 1000 m or more. In addition to sheep and goats, they breed cattle, sometimes in large herds;

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* A general survey of the Somali land Protectorate (1944-1950) - Hunt: 1951.
Natural resource inventory in Ogaden - Watson Tippet - 1971.
Maps on the distribution of water points in the Republic of Djibouti.

- The Habar Awal, based near Gabiley and Arabsiyo are typically those who migrate from the coastal plain between Bullaxaar and Lughaye and the plateau at 1000 m as far as Jijiga. Their water holes in the West border on those of the Gadabursi, and, like them, they are cattle breeders;

- The grazing lands of the Idagale and Arap are somewhat intermingled with those of the Habar Yunis. They appear to migrate in the restricted area around Adadle, Odweina and Hargeysa, spilling over into the Haud region in Ethiopia, but not descending into the coastal plain.

The three last communities also dedicate themselves to agriculture. There, draft animals are often employed and more recently tractors.

The legislation passed in recent years, and especially events in the political sphere, have somehow affected these movements. However, interviews of pastoralists carried out in various points of the project area, it appears that seasonal migration over the frontiers into Djibouti and Ethiopia continues with only the herdsmen accompanying the animals.

1.1.3 HERD MANAGEMENT AND WATERING

1.1.3.1 Herd management

In the North, Somali pastoralits raise primarily sheep, goats and camels and occasionnally cattle.

In theory, there is no breeding specialisation. However the different stocks are usually herded separately. Herding of animals varies with the seasons according to pasture availability and water requirements. The allocation of animals to individuals conditions the composition and organisation of each herds. This allocation is often done through inheritance which in turn is subject to the Islamic rule. The result is a large fragmentation of the herds.

Camels and cattle are always kept apart; as camels have the reputation of being harmful for cattle breeding.

Not all of the animals migrate. Usually a few females with their young are left behind to provide milk to have who do not participate to the transhumance. In the dry season, powdered milk is used whenever possible to make up the milk supply in the village.

Sometimes, the lands used for grazing cattle and small ruminants overlap. The various herds and flocks move around seasonal grazing lands. In the dry season, they are concentrated around permanent water points closer to the river beds; this tends to cause over-grazing. Camels, which are less dependant for watering are permanently herded in remotest areas. Then the herdsmen survive on camel milk and wild fruit and vegetables.

There is great specialisation in the responsabilities of guarding the herds, with respect to sex and age. Breeding camels are looked after by adolescents or young men, while the small ruminants, pack camels and milk-producing females are herded by married men and their families. Amongst the Issa, only young men accompany the small ruminants during migratory periods in the mountains outside Somalia.

During the rainy season, there is a tendency to gather cattle, sheep and goats around the camps and cultivated areas. Sometimes, the animals are left during the night in pens made from thorn bushes.

1.1.3.2 Watering of animals

Whereas during the rainy season water can be obtained almost anywhere on the surface or just below ground level, in the dry season, one of the pastoralists' main tasks is obtaining water for their animals and also for their own domestic needs.

At the peak of the dry season, water can be obtained from a few springs, but mainly from wells which are dug by hand in the river beds. The method used for digging the wells and pulling the water are equally rudimentary. Water is collected manually from the bottom of the well in small metal containers which are then emptied directly or passed along a chain as far as the person responsible for watering the animals. The drinking troughs, which are of small capacity, are often made of thick fabric stretched between poles.

Although occurrencies of surface water are wide-spread they are generally small and undeveloppped. Therefore providing it to human and animals is a strainuous occupation.

However in the Northwest, the difficulties encountered for watering the herds vary with the areas. In valleys and gulleys formed by toggas, the underflow and small alluvial aquifers are easily accessible and allow for regular watering. In the coastal plain water is obtained from boreholes equipped with motor pumps which are often out of work. On the plateau, where the aquifer is very deep, water is more scarce and animals are usually watered from water tanks (wara) or stock ponds which collect run off.

The water holes, which are concentrated in the river beds, are not well distributed with respect to the grazing lands. Herdsmen and sheperds, looking for the best pastures, tend to wait as long as possible before watering the animals. A survey carried out in Ogaden indicates the following periods between waterings for the various species of animal:

	Watering intervals (in days)	
	Absolute	Average
Cattle	1.2 - 3	2.4
Camels	3 - 13	9.2
Sheep	2.9 - 5.4	4.3
Goats	2.1 - 5.2	4.2

Source: Chattelier - BDPA (Ethipia).

In the North West region, the dew offsets to a certain extent the dryness of the range land and as also a depressive effect on the water requirements of the different type of animals.

Daily intake per animal for the dry season were estimated from field observations:

- Cattle : 20 l/day
- Camel : 30 l/day
- Sheep-Goat: 5 l/day

1.2 BREEDS

1.2.1 SHEEP

The sheep, commonly called Somali black-headed or Ogaden sheep belong to the "fat-rumped group"*, which is white with a black head. This type is uniform all over the Horn of Africa and is raised for mixed production (milk and meat). The skins also have a high reputation on the international markets.

This very rustic breed is perfectly adapted to a semi arid environment; in the most arid areas, it is raised along with camels.

1.2.2 GOATS

The goats raised in the region are of the Deghier breed, which is characterised by its small size, little ears and totally white or mainly white coat.

This type is particularly hardy. It is bred for milk and meat. The skins are also marketed.

1.2.3 CAMELS

In the Northwest are dromadary belonging to Mudugli breed. Known as "Somali camel", they are smaller than the Benadir breed found in the Centre and South of the country and in Kenya.

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* See I.L. Mason and S.L. Maure: the indigenous livestock of Bastein and Southern Africa, 1960.

Present all over the region, they are however often driven separately on ranges with hafty browses and for highly salty water unaccessible to other species.

They are first of all raised for their high milk production, which forms the staple diet of the pastoral community.

Meat from old animals is self consumed, the rest of the production is exported live. Some camels are also kept for domestic transport or as draft animals.

1.2.4 CATTLE

The cattle, of the zebu type, is almost exclusively of the Gasara breed, which is typical of this arid Northwest region. They are smaller than the other breeds identified in Somalia (Borana and Dawara).

They are sometimes cross-bred with Borana.

Very well adapted to the local climate, they are excellent milk producers which they are often raised for.

They are also commonly used as draft animals on the plateau in the Gebiley, Boorama area.

However, they are currently much affected by the droughts which periodically strike the region.

1.3 HERD COMPOSITION AND PRODUCTIVITY

1.3.1 HERD COMPOSITION

The information given in this paragraph result from interviews of pastoralists carried out in the fields.

The study did not allow for a survey. Besides with the severe drought* still prevailing during the assignment such exercise would have been irrelevant.

However some adult male cattle or camel are kept as draft animals. Camels are also very useful for transport.

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* April 1980.

As a result of the interviews and field investigations, the proportion of females appeared to be:

- about 70% in camel herds, 60% of which are breeding females;
- close to 60% in cattle herds, of which more than 35% are productive.

In both type of herds females are kept up to the end of their productive life. This age can reach 25 for camels.

The sex distribution of small ruminants could not be known.

Because of the drought, the demographic structure of the herds was completely modified, therefore it was not possible to assess the average size of the various zootechnical units* .

However it seemed that the size of cattle herds would vary between 10 and 40 heads.

Herds of small ruminants should be larger reaching between 80 to 100 heads.

1.3.2 LIVESTOCK PRODUCTIVITY

Lack of data on livestock distribution and offtake and the inadequacy of basic information on livestock performance restric long term planning and the definition and implementation of complementary programs in animal health, animal production, range management, etc.

These parameters can be estimated through a survey.

Informations given in the following paragraphs are purely indicative. They are derived mostly from a small number of field interviews which have been confronted to the results of surveys carried out in the Ogaden region and other semi-arid pastoral countries.

1.3.2.1 Fertility

Among ewes, the first lambing occurs between the age of 20 and 24 months. According to the breeders, the interval between two lambings in eight months on the average, and there are sometimes twins. Ewes are kept for breeding purposes up to the age of 8, and usually give birth between 4 to 8 times.

Goats begin giving birth earlier, the first kid being born after about 18 months. They are also more prolific, due to the fact that they give birth more frequently (every 6 to 12 months), that there are twins more often and that they continue having kids slightly longer. Thus, each female has an average of 10 kids.

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* Group of animals grazing together.

According to the breeders in the area, camels have their first young at the age of 5. Management of camel herds follow a very strict pattern. Females are kept as long as possible, up to the age of 25. After each birth, they are kept away from the males for about one year, ie, for almost the entire lactation period. Consequently, over a productive period of more than 20 years, they only produce about 10 times.

In the case of cattle, as a result of the difficult conditions in which they are raised, the females only begin bearing calves at the later age of about 5. According to certain surveys, the interval between calving is about 16 to 18 months. In the case of the Gasara, the fertility rate has been estimated at 60%. Il would be a little lower for the Borana. Calving may occur at any time of the year, but their are two peak periods which coincide with the rainy seasons.

Each of these species is certainly more fertile, but their poor nutrition (insufficient food and mineral deficiencies), and the fact they are subject to diseases and to parasites, are among the many unfavourable factors. The sterility, abortions and still-births which they cause are the main reasons for low fertility rates.

1.3.2.2 Mortality

In extensive stock-breeding conditions in semi-arid areas, the mortality rate is usually rather high, especially amoung young animals.

The draught did not allow for any proper investigations. However, the results of a survey conducted in the Ogaden area gives an indication of the average mortality rate of cattle.

The average animal mortality rate recorded for the cattle herd as a whole was 13.5%, distributed as follows:

- 48% up to weaning
- 30% between weaning and adulthood
- 22% during adulthood

100%

This situation can also be very much aggravated by the periodic droughts which affect the region.

In the Northwest region, the livestock has been more severely affected among the sedentary groups of the plateau than in the nomadic or semi nomadic communities.

Then, it was commonly said that close to 30% of the migrating sheep and goats were killed. It was not possible to assess this figure.

However interviews conducted by the P.I.U. in two villages Ijaara (Gebiley district) and Abaarso (Hargeysa district) among farmers* in January 1979 and 1981 demonstrated that losses where very high for those animals that had remained there.

Sheep and goats suffered the most. It seems that farmers were left with barely 1/4 to 1/3 of their herds.

As for cattle, hardly 1/3 of the sedentary herds seemed to have survived. Camels were much less affected.

1.3.2.3 Offtake

In the absence of more precise data, the norms given in the reference documents** will be used, and adjusted on the basis of the interviews carried out in the area.

Table 1.3(1)

OFFTAKE RATE (%)		
	Overall average offtake rate	Of which home consumption
Cattle	11.9	3
Sheep and goats	30	6.9
Camels	8	3

These figures, which distinguish the home consumption from the total marketed production were used to estimate the livestock population.

In this respect, the proportion of camels self consumed is quite significant, and provide most of the meat in the diet of the pastoral community. The proportion of sheep and goats marketed is large and destined mainly for export. The sale of small ruminants makes up a large part of the pastoralists' cash income.

Since the export of females is forbidden, much of the domestic consumption is made of old females. This is mostly true for cattle and camel.

Field observations and information given both by the pastoralists and dealers show that males are mainly marketed when they are adult:

- 2 years in the case of sheep and goats;
- 8-9 years in the case of camels;
- 4-5 years in the case of cattle, or even 5-7 years for castrated males.

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* 70 farmers in Ijaara, 58 farmers in Abaarso.

** Etude sur l'approvisionnement en viande de l'Afrique de l'Ouest (1973). Annuaire des Productions Animales.

1.3.3 DAIRY PRODUCTION

The dairy produce from the various herds, especially cattle and camels, makes an important part of the diet of the pastoral communities, especially during the transhumance.

Observations made in these regions have shown that in order to meet the requirements of a family of six people, including two adults, it is necessary to have 10 dairy cows during the dry season (7 during the rainy season) or three lactating camels. The milk is mainly consumed fresh, and only a very small amount is transformed into butter or cheese.

It can be marketed only during the rainy season, in the urban centres.

Estimated production for the various types of herd is as follows:

Table 1.3.(2)

DAIRY PRODUCTION		
Animal	Lactation	Production
Borana	5 - 6 months	300-400 l + consumptions by calf
Casara	6 - 7 months	500-600 l + consumptions by calf
Sheep	4 - 5 months	50 kg in total for the lamb
Goat	5 - 6 months	70 kg, ½ for the kid
Camel	8 - 10 months	3 to 12 l/day

Usually, cows are milked twice a day. Generally, milk from the ewes is kept entirely for the lambs, while only half the goats' milk is kept for the kids. All camels' milk is kept for the young camels during the early months, while afterwards they are often milked twice a day depending on domestic requirements.

Though there are and have been projects on the development of a cattle dairy farm in Hargeysa, the environmental conditions seem to be far more favorable to semi-intensified camel milk production in agro pastoral farms.

Camel is a far better milk producer than cattle under local conditions, it is a more rustic animal. Besides camel milk is more highly praised by the Somali and therefore its selling price is higher (see part III, the proposal on camel milk production).

1.3.4 LIVE WEIGHT - MEAT PRODUCTION

The weight of the animals varies considerably according to the seasons, following an irregular curve with the maxima at the end of the second rainy season, in October and November. Various sources provide information on live weight of the different species living in the region. This information is reproduced here for reference and should be considered as norms until more precise data are available.

Table 1.3(3)

AVERAGE LIVE WEIGHTS OF ADULT ANIMALS (kg)			
		Males	Females
Cattle	Gasara	305	262
	Borana	318	256
Sheep	Agbal	40	36
	Ogaden	41	31
Goats		37	37
Camels		554	514

Source : Rangeland Agency

In addition, the surveys carried out by the Livestock Development Agency give an average weight on the market of:

- 300 kg for adult males;
- between 247 kg and 283 kg for all male animals (all classes and ages together), depending on the year.

The break down into the different age groups give the following weights:

Table 1.3.(4)

AVERAGE LIVEWEIGHT PER AGE CATEGORY (kg)			
Age	Cattle	Sheep/Goat	Camel
1	70	10	130
1-3	200	25	250
3-5	300	35-40	410
5			530

Source: N.R.A.

In the Gebiley region, fattening of cattle (adult male and culled draft oxen) is a rather common practice among farmers.

Borana cattle, which are excellent meat producers, fattened in the best conditions, gave the following results:

Table 1.3(5)

COMPARATIVE WEIGHT OF BORANA ZEBUS
(kg)

Age	Traditional environment		Adami Tulo experimental farm	
	Males	Females	Males	Females
Birth	20	20	23	23
Weaning (7 months)	75	72	198	171
1 year	45	85	200	180
2 years	100	140	325	270
3 years	235	205	450	390
4 years	315	265	350	

Source : Southern Rangeland development project Part 2 Vol 3 Animal Production (Ethiopie 1974)

On the Afgooye farm, average daily gains in weight of 900 g were recorded, with maxima of 1.3 kg, when the animals were allowed as much molasses as they wished.

1.4 DRAFT ANIMALS

1.4.1 MAIN CHARACTERISTICS

Animal traction has long been known among the Somali population. It is provided either by cattle, camel or donkey. In this drought period their number would not be assessed.

Only the neck yoke is utilised, consequently the draughting power developped by either camels or donkeys is quite limited. Consequently, these animals are generally employed for light transport duties and also, as for camels, for harrowing and heavy duties have to be done by cattle.

Similarly, the swing plough which is used of a long tradition among these farmers is somewhat inadapted. It does not allow for ploughing weeds in as the mould-board plough does.

Except for a few demonstration units, there is no mould-board plough in the North.

Interviewed farmers seemed quite interested in such implements for cleaning their plots.

The droughts which have occurred in recent years and the introduction of tractors have also contributed to limit the development of animal traction.

However though highly subsidized rental prices* have contributed to develop the use of traction and in spite of the technical superiority of the implements farmers still favour draft power for all other works except ploughing.

1.4.2 PRODUCTIVE CYCLE OF DRAFT ANIMALS

Among the different type animals for traction oxen are the most valuable ones. Fattened for a short period at the end of their productive cycle, they produce excellent meat. Therefore they provide an additional source of income to the farmers.

As it has been observed this is already done by some farmers who feed them on agricultural by-products.

However, this could be improved with a more adapted food ration as a result of both new agricultural productions (see technical report N°7 Agricultural development) and the provision of mineral elements and urea.

Conducted at an appropriate time, after harvesting, farmers would sell them at the highest marketable price.

The development of such programs means that the working cycle should not last more than three years, oxen being ready for sale at the age of 6-7 years.

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* SoSh 500/ha with a tractor as against SoSh 300/ha with draft animals.

1.4.3 IMPLEMENTS

Interviews carried in the fields showed that farmers are aware and request new implements technically adapted to their agricultural environment.

This would contribute to increase agricultural production being as well a device for soil conservation.

This should be well investigated. The installation of a unit which would produce ox-drawn, mould-board ploughs and other implements file for donkeys and camels as well as carts is one possibility (see part I Simultaneously, the organisation of a training for local blacksmith would allow for proper maintenance of these equipments.

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Chapter 2

LIVESTOCK POPULATION

2.1 GENERAL COMMENTS

In 1980, there had never been a count of the total livestock in Somalia. This, however, is indispensible to the definition of any rangeland and animal production project . Already carried out in the central region of the country, the aerial survey was extended to the north in 1981.

The available statistics make any estimate of the total livestock numbers in the north west very hazardous. Several methods have been used to try to assess the number of animals in the area under study, in 1979-1980.

Most of the statistics date from before the 1973-74 drought, and thus do not bear its depressive effects, nor various events of a similar nature which have occurred since.

The estimates of the livestock population in the north west and in the project area have been drawn up on the basis of the following:

- The various estimates of the national herd;
- The 1975 administrative census, and certain regional estimates;
- Vaccination figures;
- Marketing statistics (slaughtering, exports of meat, animals, hides and skins);
- A field survey in the project study area.

2.2 ASSESSMENT OF THE DIFFERENT STATISTICS

2.2.1 NATIONAL ESTIMATES

Since 1964, the National Authority and various institutions have had to make estimates of the national herd. These figures, which are given in table 1.2(1), do not go beyond 1975. Since then, the Ministry of Livestock has not made any estimates.

The figures provided by the 1975 official census would appear to be far too high, in particular with respect to the total number of sheep, goats and camels, and they, thus, cannot serve as a reference.

Table 1.2(1)

LIVESTOCK NUMBERS IN SOMALIA
(10^3 head)

Source	Year	Cattle	Sheep/Goats	Camels
Halilovic	1964	1 400	10 530	2 970
Hastley	1966	1 400	7 000	2 000
Vonhorn	1968	2 000	7 000	2 000
Pillaüs Hastley	1968	2 500	9 000	2 500
Polack	1969	1 980	14 000	2 000
Citaco consultants	1970	2 000	-	-
Livestock Yearbook (SEDES)	1972	2 550	15 900	2 040
Livestock Ministry	1972	4 000	-	-
EAMA Study (EEC)	1974	4 000	15 000	3 000
Census	1975	3 750	24 650	5 300

2.2.2 REGIONAL ESTIMATES

These overestimates are again reflected in the regional breakdown of the 1975 national census (Table 1.2(2). However, the margin of error will vary according to the species and the regions.

(See table on the following page).

Table 1.2(2)

LIVESTOCK NUMBERS BY REGION
(in thousands of head)

	Camels	Cattle	Sheep	Goats
North West	600	145	2 242	3 076
Togdheer	320	44	917	992
Sanaag	205	74	1 521	664
Bari	240	15	1 388	2 095
Nugaal	155	12	223	611
Mudug	751	340	1 136	2 744
Gaguduud	395	218	588	1 734
Hirran	461	170	287	1 159
Sh. Dexe	236	366	325	720
Mogadishu	1	22	6	19
Sh. Hoose	293	419	90	200
J. Hoose	297	1 036	81	177
Gedo	784	528	500	725
Bay	362	255	55	192
Bakool	192	100	79	274
Totals	5 298	3 744	9 438	15 212

Source: State planning Commission
1975 General Census

As a first analysis, it is obvious that a livestock population equivalent to 1 306 000 LU for the north west region is quite out of keeping with the region fodder resources. In this case, the carrying capacity would of 0.34 LU/ha.

Other more recent estimates conducted either by the central Administration or the regional authorities are totally contradictory and even irrelevant. There, only 1.33 ha would be sufficient to maintain 1 LU all the year round whereas the vegetation survey has shown that the range average carrying capacity is of 9.5 ha/LU*.

Table 1.2(3)

ESTIMATED NUMBERS OF LIVESTOCK IN THE NORTH-WEST REGION
(no of head)

	1972 (a)	1975 (b)	1979 (c)
Cattle	200 000	145 000	941 400
Camels	(...)	600 000	1 600 000
Sheep	(...)	2 242 000	4 900 000
Goats	(...)	3 079 000	

(...) not estimated
Sources: (a) Animal production yearbook
(b) General census
(c) Ministry of Livestock estimates

* See Part I - Chapter 3 - § 3.5.

Local officials at the district level make estimates on their field trips. The information which could be collected, are incomplete, and reveal considerable discrepancies. However, for the district of Boorama, leaving aside all the others, it would appear that the data provided by a census undertaken at the request of the Ministry of the Interior in 1978 may in fact be taken into consideration and serve as a guide.

Table 1.2(4)

	Boorama		Gebiley	Berbera
	(a)	(b)	(b)	(a)
Cattle	50 000	76 000	900 000	-
Camels	30 000	55 700	200 000	20 000
Sheep Goats	500 000	990 000	4 590 000	2 000 000

(a) Ministry of livestock statistics - 1979
(b) Local government. 1978 survey by the Ministry of the Interior

The figures from the Gebiley district are obviously wrong. The lack of homogeneity and incomplete character of these figures makes any attempt to provide a breakdown of livestock by district quite impossible.

2.2.3 VACCINATIONS

National Statistics on vaccination date from the JP 15 campaigns and go back as far as 1976. They would seem to indicate a national figure of 2 million head of cattle. This is almost half that advanced by the Ministry of Livestock. Statistics on annual vaccination are of no use in this respect, since they concern animals intended for export more than anything else.

2.2.4 MARKETING STATISTICS

Finally marketing statistics on slaughtered animals, on livestock exported from Hargeysa, on the collection of hides and skins appear to be the most reliable and coherent ones.

All these statistics which are presented in chapter 4, Part II, have been used to produce an estimate of the livestock population in the North West region.

2.3 LIVESTOCK POPULATION

2.3.1 PROPOSED ESTIMATE FOR THE NORTH WEST REGION IN 1979-1980

These proposed estimates result from a test and trial approach. Starting from the different statistics on livestock marketing in 1979 the purpose has been to:

- undertake tests of their coherency using accepted parameters on livestock productivity, Part II chapter 1, and,
- Carry out comparisons with known livestock performances in other pastoral semi-arid countries.

As a result, the following figures are proposed as probable estimates of the livestock population for the North West region in 1979-1980.

Table 1.3(1)

PROBABLE LIVESTOCK POPULATION IN NORTH WEST REGION IN 1979-1980

	Number of heads	Head/km2
Cattle	120 000 to 145 000	2.7 to 3.3
Camels	160 000 to 180 000	3.6 to 4.3
Sheep and goats	2 200 000 to 2 500 000	49.0 to 57.7

These estimates, which do not take into account the seasonal fluctuations, give an indication of the average number of animals susceptible to stay in the North West region in 1979-1980. Seasonal livestock-population can be known only through specific surveys.

These livestock estimates once translated into livestock units (LU) give an average carrying capacity of 0.11 LU/ha. This means that a minimum of 8.8 ha are required to feed one LU all year round.

Besides, all of the range cannot be evenly pastured: some areas are difficult of access or cannot be reached. Also, the distribution of the water point is a constraint in the dry season.

Therefore, the confrontation of these results to the estimated average annual range carrying capacity of the north west resulting from the vegetation survey tends to prove that the region is 'chronically' overgrazed in the zones with higher livestock density. The animal losses occurring during the droughts which periodically strike the region are a direct consequence of this situation.

2.3.2 FIELD SURVEY IN THE PROJECT STUDY AREA IN SEPTEMBER 1980

A field survey was also conducted in the project study area in September 1980.

The method has consisted in counting out systematically all the animals encountered in various observation strips. These strips* were chosen in the different ecosystem identified for the vegetation study according to their distribution within the five bioclimatic zones.

For this survey, a total of 1050 km of strips were travelled thus covering 3.7 % of the project study area**.

The results of this survey allow for an estimate of the livestock population present in the project study area by the end of the drought and which had had to survive on a scanty range. Therefore, the figures presented in table 1.3(2) are also a seasonal estimate of the livestock population in the area and reflect the conditions of this specific period.

Table 1.3(2)

LIVESTOCK POPULATION ESTIMATE IN THE PROJECT STUDY AREA
(September 1980)

Bioclimatic zone	Area (km2)	Total Head			
		Sheep	Goats	Camels	Cattle
Coastal	9 321	13 000	26 000	6 500	100
Subcoastal	8 766	35 700	45 300	18 300	-
Acacia bussei	7 178	44 500	87 500	48 800	7 200
Acacia etbaica	7 532	57 200	37 700	46 700	31 600
Evergreen	725	6 100	7 300	1 200	900
TOTAL	33 522	156 500	203 800	121 500	39 800

(rounded figures) - SOGREAH field survey.

A close analysis reveals that the pastoralists have been very consistent in the management of their herds. In that year, the range carrying capacity had to be estimated in relation to only one rainy season. This allowed only for 14.5 ha/LU whereas as a result of this survey 15.7 ha/LU would have been required.

There again overstocking of the range was taking place justifying the heavy losses in the sedentary areas. But, it also confirms the interviews carried out in the early spring in which the pastoralists indicated that they were transferring their herds outside of the region and would migrate into the Ogaden.

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* The width of the different strips was 1.5 km in open land 1.2 in undulating terrain and 1 km in mountainous areas.

** The area surveyed in each bioclimatic zone is coastal zone 449 km2, subcoastal zone 117 km2 Acacia bussei 317 Km2, Acacia etbaica 325 km2, evergreen 37 km2.

2.3.3 AERIAL LIVESTOCK CENSUS (March 1981)

The aerial resource inventory carried out in the Central Rangeland Project area was extended to the north of Somalia. It involved two flights, one in each season.

The survey of the north west region took place first in March-April 1981 and again in September 1981.

Preliminary estimates of the first flight for the project study area are given below.

Table 1.3(3)

ESTIMATE OF THE LIVESTOCK POPULATION IN MARCH-APRIL 1981*
(Aerial census RMR)

	Area	Sheep	Goats	Camel	Cattle
Project study area	33 522	680 100	829 210	164 110	98 820

Preliminary results - Unit : km2 - Number of heads

In March-April 1981, there was already heavy rains and some areas were flooded.

Here again, the figures are representative of this unusual climatic season when the flight took place.

No direct comparison can be made with the seasonal estimate of September 1980. All that can be said, is that overall losses of the livestock were probably less than initially thought of. Pastoralists, both semi-nomads and nomads, had been able to drive their herds to other regions, thus minimizing their losses. Only sedentary herds have been severely affected.

2.4 LIVESTOCK GEOGRAPHICAL DISTRIBUTION

The survey conducted in September 1980 also gives indications on the distribution of the different stocks at that time within the five bioclimatic zones.

Table 1.4(1)

LIVESTOCK DISTRIBUTION
in September 1980

	Sheep	Goats	Camel	Cattle	All livestock (LU)
Coastal	8.3	12.8	5.4	0.2	5.4
Subcoastal	22.8	22.2	15.1	-	14.1
Acacia bussei	28.5	42.9	40.1	18.1	36.8
Acacia etbaica	36.5	18.5	38.4	79.4	42.1
Evergreen	3.9	3.6	1.0	2.3	1.5
TOTAL	100.0	100.0	100.0	100.0	100.0

SOGREAH Field Survey

As indicate in the table above:

The total animal biomass increases with the plant biomass. The greatest concentration of animals (42.1 %) was found in the Acacia etbaica zone. Almost 80 % of the livestock could be found in the two Acacia zones. Then, fodder trees were vital to feed the animals and tree pruning was systematic. Concentration may be less in more normal years.

Sheep and cattle were more concentrated on the plateaux in the Acacia etbaica zone which offers a milder temperature and a more developped herbaceous layer.

Goats and camels were mostly found in more woody areas searching for green browser.

In these semi arid regions, subject to irregular climatic condition, transhumance and mobility are and will remain a necessity. However though pastoralists are quite rational in the way they manage their herds in relation to the range productivity, it appears that there is a chronical overgrazing. Some areas are highly overgrazed while others are neglected or poorly pastured.

In this extensive mode of production, only a comprehensive rangeland development plan and the granting of exclusive grazing rights to pastoral groups will allow for the development of animal production. Such a programme, which is the responsability of NRA, is described in the NRDP Phase II identification study document.

Otherwise animal production can be developped in association with agriculture for exemple in camel milk producing agro pastoral farms or through fattening schemes for draft animals (oxen or camels).

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Chapter 3

ANIMAL HEALTH SITUATION IN THE NORTH WEST

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3.1 GENERAL COMMENTS

The present Animal Health situation reflects both the pathogenes specific to the region and those brought in by herds for export, and the prophylactic measures undertaken by the Department of Health in the MLFR. The incomplete and sometimes contradictory documents obtainable from the national and regional authorities do not enable a precise description of the present situation to be made. However, they do show that the major epizootic diseases (rinderpest, contagious bovine pleuropneumonia, sheep pox, anthrax, black quarter) have hardly been brought under control since the end of the JP 15 campaign. The Animal Health policy oriented towards curative measures rather than preventive action and lack of financial resources and logistics explain this situation.

3.2 BUDGET

From 1974 to 1979 budget allocations to livestock production increased in Somali shillings from 18.9 million to 67.2 million (see table 3.2(1). This increase of 250% is still very modest when compared with a national budget which increased by 420% over the same period. It, in fact, represents a decrease of 31% in the share of the national budget allocated to the livestock sector which fell from 5.4% in 1974 to 3.7% in 1979. The credits initially granted in 1980 do not indicate that this situation has improved.

With a median value of 4% of the national budget, the livestock budget remains from 7 to 48% (depending on the livestock figures used) below the required budget for animal health alone, according to accepted standards for countries under similar conditions. These standards allow for approximately SoSh 6 per veterinary unit*.

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* Veterinary Livestock Unit: 1 VLU = 1 zebu = 1 camel = 10 sheep = 10 goats

Table 3.2(1)

YEAR BY YEAR COMPARISON OF THE NATIONAL AND LIVESTOCK BUDGETS
Budgets implemented from 1974 to 1979
(in millions of SoSh and $)

Years	Budget for stock-breeding (1)	National budget (2)	% (1)/(2)
1974	18.9	350.8	5.4
1975	14.4	354.5	4.1
1976	24.9	624.4	4.0
1977	36.4	945.1	3.9
1978	66.6	1 163.3	5.7
	50.8	1 352.2	3.7
1979	67.2	1 838.0	3.7

Source : 1974-1978 State Planning Commission, quoted in the World Bank report.
1978-1979 Statistical Abstract, State Planning Commission.

3.3 INFRASTRUCTURE AND PERSONNEL

The stock-breeding infrastructure in the North West region consists of a provincial headquarters, 6 district headquarters and 29 (or 22 according to other sources) veterinary posts. Each of these various bodies has at least one employee. In addition, the employees forming the two 'mobile teams', whose job is to vaccinate livestock at gathering points, are underemployed because of the lack of material resources.

The Department of Health's activities relies on the veterinary laboratories of Hargeysa and Mogadishu*. The latter is also responsible for the production of vaccines.

These laboratories have shown up a large number of infectious diseases and parasites.

Table 3.3(1)

ORGANISATION OF THE ANIMAL HEALTH AND LIVESTOCK SERVICE IN THE NORTH WEST REGION

Region	District	Post (Sub-station)
Hargeysa	Boorama	Adanka Dila Bown Qoljeit Pegaro-Lagar (a) Baki (a) Ruqil) Goraya-Cowl (a) Walaalgo (a) Weeraar (a) Ruqi (a) Baysaare (a)
	Saylac	Jidhi Ceel Gaal Lawaada Takoshi (Saylac)
	Lughaye	Gargaara Waraqadhigta Cali Xaydh
	Gebiley	Arapsiyo Salanyare (Boocda-Kaboab) Kulmie (Kalabaydh) Tog Wajale
	Hargeysa	Faraweyne Salahalen (Qool Cadday) Balay - Caanood Balaykadar (Qool Cadday)

Source : Livestock Ministry - Hargeysa (a) Boorama district.

3.4 ANIMAL HEALTH

Vaccinations are given free of charge by the officers of the Ministry of Livestock, while anti-parasite products and substances intended for the individual care of animals have to be paid for.

Preventive measures concern the following diseases:

- Rinderpest;
- Contagious bovine pleuropneumonia (CBPP);

- Anthrax;
- Black quarter;
- CCPP (sheep);
- Haemorrhagic bovine septicaemia (HS);
- Sheep pox;
- Enterotoxemia;
- Newcastle disease.

Statistics for the vaccinations carried out in recent years are given in tables 3.4(1) to 3.4(4).

The various figures provided stress obvious incoherences. For example in 1979, the breakdown of immunisations carried out in the North West (tables 3.4(1)) shows that for the four main diseases (rinderpest, CBPP, anthrax and black quarter), a total of 190 954 vaccinations were administered, as against only 15 196 mentioned (table 3.4(2)) in the reports from the districts in the North West region, whereas the Hargeysa Laboratory states that 1 055 589 vaccinations (table 3.4(3)) were administered in the same year from 119 645 doses of vaccine (table 3.4(4)). From the statistics available, therefore, it is not possible to assess the extent of vaccination in the North West. However, the following points should be made:

- in administering vaccine, priority seems to have been given to the herds destined for exports;
- activity is hampered by the lack of material resources, and in these circumstances, the number of immunisations actually carried out is probably in the vicinity of 100 000. There is no preventive animal health policy.

Given the absence of equipment, the administration of vaccinations depends mainly on the number of heads of cattle intended for export, and on weather conditions, which draws the herds closer to the vaccination points. Thus, between 1977 and 1979, the Boorama district carried out no vaccinations at all. If an attempt was made to collect information and check its coherency, this shortage would be underlined and those responsible for animal health could present the authorities with all the relevant arguments to obtain the funds they need.

Rinderpest has never been eradicated from Somalia, although during the JP 15 campaign a maximum of 1 743 128 anti-rinderpest vaccinations were given in 1969-1970, thus enabling an estimated 87% of the cattle to be immunised*. The reduction of anti-rinderpest vaccinations from 1 131 543 in 1976 to 482 819 in 1978 means that the health of the national herd cannot be guaranted.

The number of immunisations against CBPP** is less than a million a year (maximum reached in 1977 was 912 228), and just as inadequate.

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* O. von Lücke and H. Pilz : Tierische Produktion und die Aufgaben des Veterinärwesens in der Demokratischen Republik Somalia (Veterinärmedizin in Ausland).

** See table 2.4.(1)

Table 3.4(1)

NUMBER OF VACCINATIONS ADMINISTERED PER DISEASE IN THE NORTH WEST AND IN SOMALIA AS A WHOLE *
during 1976-1979
(No. of head)

		1976	1977	1978	1979
Rinderpest	North West	6 000	27 491	-	84 874
	Somalia	201 543	862 815	482 819	794 000
CBPP	North West	6 700	27 765	-	30 460
	Somalia	721 000	158 000	569 321	759 000
Black quarter	North West	-	-	-	11 080
	Somalia	141 900	98 362	378 000	475 000
Anthrax	North West	6 000	1 729	-	64 560
	Somalia	467 627	210 079	439 487	782 000
Sheep pox	North West	(...)	(...)	(...)	18 400
	Somalia	(...)	199 000	31 000	156 000

* Some figures are subject to doubt and periodically revised.

Source : Statistical Abstract - State Planning Commission - Ministry of Livestock.

Table 3.4(2)

TOTAL NUMBER OF IMMUNISATIONS (ALL TYPES) CARRIED OUT PER DISTRICT
(No. of head)

District	1977	1978	1979
Hargeysa	2 066	1 933	3 473
Berbera	1 587	2 456	2 892
Gebiley	3 123	1 077	2 646
Saylac	978	906	1 748
Lughaye	2 106	2 000	2 660
Boorama	2 506	828	1 837
Total for North West	12 366	9 200	15 196

Source : Ministry of Livestock.

Table 3.4(3)

VACCINATIONS CARRIED OUT IN 1979
(No. of head)

Rinderpest	562 634
CBPP	264 304
Anthrax	130 186
Black quarter	98 465

Source: Veterinary Laboratory at Hargeysa.

Table 3.4(4)

DOSES OF VACCINE ORDERED IN 1979 (no. of doses)	
Rinderpest	56 483
CBPP	23 649
Anthrax	20 864
Black quarter	18 649
Pleuropneumonia (sheep)	124 636

Source : Hargeysa Animal Health Laboratory.

The two main epizootic diseases affecting the cattle - rinderpest and CBPP - are not yet under control.

With respect to small ruminants, it seems that sheep pox and pleuropneumonia most hinder the development of the two species.

Controlling these diseases is a prerequisite to the development of any livestock production programmes.

This prerequisite could be met thanks to the production capacity of the laboratory, which seems to be able to meet demands for the main vaccination (see table 3.4(5) below).

Table 3.4(5)

PRODUCTION OF VACCINE (No of doses)						
	1974	1975	1976	1977	1978	1979
Rinderpest	-	-	-	-	1 000 000	5 000 000
CBPP	-	-	3 972 816	150 000	1 000 000	850 500
Pleuropneumonia*	1 433 050	-	-	200 000	500 000	2 374 100
Anthrax	99 750	-	-	130 140	748 000	534 428
Black quarter	568 100	-	-	512 250	92 480	541 830
Haemorrhagic septicaemia	-	-	361 250	255 200	746 000	809 650
Newcastle disease	-	-	75 000	72 000	294 000	11 210
Enterotoxemia	-	-	-	-	120 000	-
Sheep pox	-	-	-	-	177 000	2 000 000

* Small ruminants.

Source: Statistical abstract - State Planning Commission - Information from the Ministry of Livestock.

With regard to the prevention of parasitic diseases, after having guaranted the distribution of the necessary products via a commercial organisation, drug distribution was later restricted to veterinary posts and the mobile teams. It would have been interesting to analyse the reasons for this measure as well as its consequences. Initially, it would appear that the low density of the veterinary posts constitutes an obstacle to supplying the pastoralists. The treatment of parasitic diseases seems to have stagnated during the past few years (see table 3.4.(6)):

. With regard to endoparasites:

- The treatment of small ruminants has maintained: 333 767 units in 1978, which indicates that the pastoralists were becoming aware of the problems;

- The treatment of cattle (36 706 in 1978) and camels (65 035 in 1978) is still quite out of proportion with the magnitude of the problem;

With regard to ectoparasites, in spite of a policy of dipping tanks, which are not properly adapted to the ecological environment. Pastoralits have shown their interests for such treatment. In 1978, there was:

- 1 136 126 treatments of camels;

- 993 497 treatments of cattle;

- only 222 775 treatments of small ruminants.

The conclusion to this analysis is that the Animal Health is by no means under control in the North West. This redeems the development of any livestock and range management programme. Therefore, prior to implementing animal production schemes, it is necessary to maintain that national wealth made of the livestock, through the organisation of an efficient preventive health department and veterinary service. This proposal is detailed in Phase II to the Northern Rangeland Development project.

Table 3.4(6)

ANTI-PARASITE TREATMENT IN THE NORTH WEST REGION
AND IN SOMALIA AS A WHOLE (1976-78)

(number of head treated)

Anti-parasite treatment	Years	Sheep - goats		Cattle		Camels	
		North-West	Whole country	North-West	Whole country	North-West	Whole country
TRYPANOSOMIASIS	1976	7 187	222 775	1 042	1 255 766	10	10 251
	1977	352	85 510	19	761 733	-	8 701
	1978	-	92 464	-	513 697	-	5 769
ECTOPARASITES -	1976	11 937	333 571	6 458	932 802	9 288	1 039 651
	1977	2 960	65 369	17 928	612 911	18 948	797 646
	1978	65	222 775	939	993 497	4 099	1 136 126
ENDOPARASITES	1976	102 435	359 352	2 892	49 725	6 995	37 536
	1977	142 880	298 505	3 676	28 532	4 712	19 852
	1978	34 711	333 767	1 156	36 706	34 711	65 035

Source : Statistical abstract - State Planning Commission - Ministry of Livestock

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Chapter 4

MARKETING

4.1 LIVESTOCK PRODUCTION IN THE NATIONAL ECONOMY

Stock-breeding has a particularly important place in the Somali economy. In addition, it contributes to a very great extent to the balance of trade, as in 1979 it accounted for 87 % of exports in value, ie. some 600 million SoSh.

4.1.1 REVENUE FROM LIVESTOCK EXPORTS

Livestock production accounts for an overwhelming and growing proportion of the revenue from exports (60 % in 1970 and more than 85 % of the total in 1979). Most of the receipts are due to the shipment of live animals - cattle, camels and especially sheep and goats, with the remainder being provided by hides and skins, while the export of fresh and/or canned meat is interrupted until the processing (and packing) plants are brought back into operation.

Table 4.1(1)

ANIMAL PRODUCTS IN THE REVENUE FROM EXPORTS
(FOB figures)
(in millions of SoSh*)

	1975		1976		1977		1978		1979**	
	Value	%	Value	%	Value	%	Value	%	Value	%
Live animals	382.0	68.5	281.2	47.2	279.5	70.8	588.7	83.2	555.2	78.9
Meat	44.1	7.9	43.0	7.2	13.2	3.3	0.7	0.1	5.9	0.8
Hides and skins	26.2	4.7	51.0	8.6	9.5	2.4	29.7	4.2	53.1	7.6
Total exports	557.6	100.0	595.5	100.0	394.5	100.0	707.4	100.0	703.9	100.0

* 1 US $ = 6,06 SoSh.

** Preliminary results.

Source: Foreign exchange statistics - Central Bank.

4.1.2 THE LIVESTOCK SECTOR IN THE THREE YEAR PLAN 1979-1981

In the Three Year Plan, the primary sector accounted for 35.4 % of planned expenditure, of which a quarter was for animal health and livestock production. Out of the 630.8 million SoSh earmarked to finance 32 stock-breeding projects, 44.7 % ie. 282.5 million was for production and marketing. This amount was distributed as follows :

No. of projects	Millions of SoSh	Type of project
9	92 000	Animal production (cattle and sheep)
6	134 000	Poultry production
2	6 500	Hides and skins
5	50 000	Marketing of livestock

Amongst the production measures on the programme were ranching projects, cattle and sheep fattening schemes, dairy farms and poultry production (eggs and chickens) (see attached list).

In the field of marketing, the construction of an abattoir with cold storage facilities at Hargeysa was envisaged, together with the development of stock routes and holding grounds reorganisation of export infrastructures at the embarkation points, in particular at Berbera.

4.2 MARKETING ORGANISATION

In addition to the traditional market circuits, various State-run or para-statal organisations and institutions are involved in the marketing of livestock and animal products.

LIST OF PROJECT IN THE 1979-1981 TYDP
CONCERNING THE NORTH WEST REGION

-

. Profile No 4: Anti-parasite treatment centres all regions:

48 sheep treating centres: 60 mobile teams to spray camels.

Aim to improve the quality of hides and skins for export and for Somali industry.

Total cost: 1 862 000 SoSh.

The equipment would be paid for by the breeders themselves.

. Profile No 5: Prevention of the principal epizootic diseases (rinderpest, CBPP and black quarter):

12 million vaccinations of cattle annually throughout Somalia. The vaccines are produced by the Mogadishu centre.

Total project cost: 8 025 000 SoSh.

. Profile No 11: Hargeysa Farm:

Stock-breeding centre for the production of milk and young animals to be distributed to local breeders.

5000 ha, of which 200 ha would be used for growing fodder crops.

Total cost: 7 010 000 SoSh.

. Profile No 17: Hargeysa Poultry Farm:

This project is intended to complete that started in 1974, which is to supply eggs, meat and chickens for the local population.

Total cost: 3 845 000 SoSh.

. Profile No 19: Hargeysa Abattoir:

This project involves the construction of an abattoir with a daily capacity of 1200 sheep and 100 cattle, to be located near the cold storage complex built in 1973-1975, which is capable of storing carcasses for a week. The aim is to export frozen meat by air to Saudi Arabia.

Total cost of the projected operation: 6 500 000 SoSh.

. Profile No 21: Holding grounds at Qool Cadday and Galbeed

Installation of Holding grounds to regulate livestock marketing. Improvement of water supply and fencing off of reserved pasture land.

Total cost: 3 970 000 SoSh.

. Profile No 23: Drought emergency measures

Development of rangeland areas, each covering 1000 km2; irrigated fodder crops; storage of water reserves.

Training of pastoralists.

Total cost of scheme: 105 966 000 SoSh.

4.2.1 LIVESTOCK MARKETING

A Livestock Development Agency (L.D.A.), run by the Ministry of Livestock, was created in 1966 to promote animal production, improve the marketing of livestock for the purpose of exporting live animals, and to ensure the supervision of shipments.

With this end in view, the LDA, which had a regional office in Hargeysa, installed holding grounds with fodder reserves one of which is at Qool Cadday in the North West region ; it developed stock routes and built a quarantine station at Berbera to check the animals for export.

The L.D.A. was also directly involved in marketing at three markets in the North West, at Qool Cadday, Tog Wajale and at Allaybalay, where the buying season lasts from June to September. However, the LDA's own purchases were restricted to cattle and limited, as they only account for 7.6 % of the number of officially controlled exported cattle. As a result, the marketing of livestock is still primarily a matter of private enterprise, organised by traditional dealers.

Moreover, the poor performance of the LDA has conducted to its being dissolved in 1981 and the abolishment of the monopoly on exports. The management of the various installations has been transfered to N.R.A.

4.2.2 HIDES AND SKINS

4.2.2.1 Hides and Skins Agency

The Hides and Skins Agency, which is also dependent on the Ministry of Livestock, has a monopoly on the collection and marketing of hides and skins, and in particular their exportation from Mogadishu. The Agency has the same general obligations as the Livestock Development Agency:

- rationalisation of the collection circuits ;
- improvement of the quality of hides and skins both at the skinning and drying stages ;
- organisation of marketing and search for foreign markets.

There is a regional branch of the Hides and Skins Agency in Hargeysa. Up to 1979, the Agency was only concerned with the collection of skins (sheep and goats), and was responsible for more than 80 % of the skins exported from Somalia. The collection of hides (cattle and camels) is still very much a peripheral activity, and the hides are intended for local industries, especially tanneries, of which the Agency is the sole supplier (the same goes for the skin processing industry).

The North West regional branch has several collection points and is very active in the Hargeysa, Gebiley, Berbera and Boorama districts. On the other hand, its activities are far more limited in the Lughaya and Saylac districts, which are naturally oriented to the terminal market of Djibouti. This observation was confirmed in discussions with local breeders.

Table 4.2.(1)

HIDES AND SKINS COLLECTED PER DISTRICT
(no. and % of total)

	1978		1979	
	Number	%	Number	%
Hargeysa	614 000	84	592 500	80
Gebiley	52 600	7.2	90 000	12.2
Boorama	36 500	5	15 000	2
Lughaya	ε	ε	3 000	0.4
Saylac	4 300	0.6	3 000	0.4
Berbera	23 400	3.2	37 000	5
Rounded total	731 000	100	740 500	100

Source : H.S.A.

4.2.2.2 Hides and Skins Industry

This is a State-owned factory whose role is to treat skins and hides. It is directly responsible to the Ministry of Industry. There is a processing plant at Hargeysa which produces pickled skins for export, mainly to European countries.

The plant, which has been in operation since the second half of 1978, is capable of treating 4000 skins a day. The supply of hides and skins is the monopoly of the Hides and Skins Agency.

Still facing technical problems the factory was running at 10% of its capacity in 1980.

Its activities were suspended in 1981.

4.3 DOMESTIC TRADE

4.3.1 LIVESTOCK MARKETING

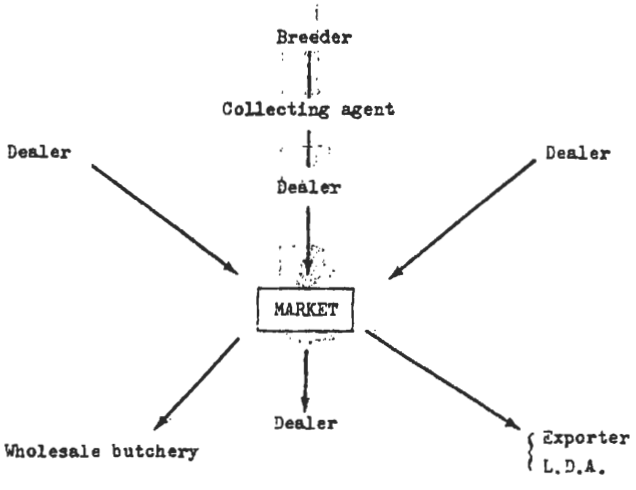
3.3.1.1 Marketing circuits

The marketing of livestock in Somalia is carried out in the traditional manner, which can be observed in many countries of tropical Africa. It would appear, however, that the circuits are fairly direct and only a limited number of middle-men are involved.

Apart from exchanges between breeders, two main circuits were observed, according to whether the animals are intended for the local urban population or for export. Animals for supplying meat to the urban centres are generally sold per head or per lot by the breeders themselves or by dealers at the market. Dealers may employ collecting agents who make up lots by buying livestock directly from the breeders. Animals which are unfit for export, in particular sterile or rejected females, are also channelled into the local markets.

Animals for export are also bought by exporters or by the LDA at the collection markets, or assembly markets such as Hargeysa.

The livestock marketing circuit can thus be represented diagrammatically as follows:



4.3.1.2 Markets and activities

According to the information collected, there are five main markets in the North West, at Tog Wajale, Allaybalay, Hargeysa, Qool Cadday and Berbera, to which may be added the district centres of Gebiley and Boorama. The market at Tog Wajale, which is close to the frontier, also attracts animals from Ethiopia. All these markets are officially controlled, but activities are nevertheless only imprecisely or indirectly known, and when it is possible to obtain information, this is in the form of the amount of taxes levied by the local authorities .

Table 4.3 1)

ANIMALS OFFICIALLY OFFERED FOR SALE ON THE MAIN MARKETS, 1979
(number of animals)

	Gebiley	Tog Wajale	Allaybalay	Hargeysa*	Boorama**	Berbera*
Cattle	1 000	9 100	5 200	(...)	7 500	(...)
Sheep and goats	6 000	61 700	67 000	(...)	142 000	(...)
Camels	175	1 600	55	(...)	4 000	(...)

* No information available.

** District as a whole.

Despite the fact that detailed statistics were unobtainable, the total amount of market taxes levied in the Hargeysa district is nevertheless a clear indication of the size of the assembly market at Hargeysa and the collection market at Qool Cadday. In 1979, these taxes amounted to about 2 400 000 SoSh, ie. almost three times as much as the taxes collected by the district of Gebiley, in which are the two large collection markets at Allaybalay and Tog Wajale.

With regard to market activity, seasonal fluctuations can be observed, with sales reaching maximum during the two rainy seasons. The peak sales seem to occur during the months of September and October.

From an analysis of these statistics, it would appear that a large number of animals, in particular those intended for export, do not pass through the markets.

* Market taxes levied on livestock per district in 1980 (in SoSh)

	Hargeysa	Gebiley	Boorama	Berbera
Cattle	20	20	15	20
Sheep and goats	5	5	5	5
Camels	30	30	15	30

These taxes have not changed since 1978.

4.3.1.3 Livestock marketing agents

Apart from the breeders, who market their animals directly or exchange them amongst themselves, the people involved in the marketing of livestock are the L.D.A., the dealers and/or collectors.

The L.D.A. had opened three purchasing centres at Tog Wajale, Allaybala and Qool Cadday, where its agents operated during the buying campaign. Dealers buy animals either directly or via collectors, whom they pay. The dealers have to pay a levy to the local authority, which varies from 60 to 200 SoSh par annum, depending on the district.

According to the official registers, there are about 1150 livestock dealers and collectors, of whom 650 are registered at Hargeysa, 90 at Gebiley, 400 at Boorama, and 5 at Berbera. Even though livestock trading is a well developed activity, it would appear that these figures in fact exceed the real ones, especially in the case of the Boorama district, where the figure provided by the local authorities almost certainly almagamates wholesale dealers.

4.3.2 MEAT PRODUCTION

4.3.2.1 Slaughtering

The amount of controled slaughtering which occurs in the urban areas can only be partially known from the taxes collected by the local authorities. The figures below were therefore calculated from the taxation figures.

Table 4.3(2)

ESTIMATED SLAUGHTERING IN THE URBAN CENTRES IN 1979

	Gebiley	Hargeysa	Boorama	Berbera
Cattle	450	3 750	500	270
Sheep and goats	15 000	115 000	16 000	8 000
Camels	500	1 200	800	360

The figures quoted must be used with precaution, but it should be possible to obtain figures for the number of animals slaughtered under controlled conditions by carrying out spot checks and by systematically recording the number of animals killed. This is not done at present. Such records could be kept by the veterinary inspectors.

* Slaughtering taxes per district in 1980 (in SoSh)

	Hargeysa	Gebiley	Boorama	Berbera
Cattle	5	6	10	6
Sheep and goats	2	2	3	2
Camels	7	10	10	12

These taxes have remained unchanged since 1978.

On the basis of the number of animals slaughtered, and bearing in mind the average estimated weights of the animals , an attempt may be made to assess the average meat consumption per urban inhabitant. Taking the estimated population figures quoted in the Technical Report No 9 on Population, the average consumption of meat and offal by urban inhabitants would range from 8.5 to 10 kg per annum. This is an acceptable level compared with other African countries, and which seems compatible with the selling prices for meat, which are quite high (see § 4.4.2).

With respect to slaughtering in the rural areas, in the absence of records, there is no basis on which to make an estimate.

4.3.2.2 Organisation of the profession

There are four types of butcher in the profession : wholesale butchers, slaughterers, retail butchers and tripe butchers. According to the levies paid to local authorities* there are 375 butchers working in the four main towns in the North West region, almost half of them in the town of Hargeysa alone.

Table 4.3(3)

REGISTERED BUTCHERS (number)			
Hargeysa	184	Boorama	97
Gebiley	64	Berbera	30

Within the profession, there is great specialisation of activity. Selling of mutton and goat meat is done exclusively by women, who are also slaughterers. Cattle and camels are slaughtered by wholesale butchers or slaughterers, who also employ dressers. Women are then involved in retail selling.

All animals have their throats slit close to the ground, according to the Islamic custom. A modern abattoir with cold storage facilities was projected, to export frozen meat to the Arabian peninsula, but as the profitability of the plant was not proven by the relevant studies, it is still unfinished. As a result, all that exists in the North West region are slaughtering compounds, which are generally cemented.

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* Levies paid by butchers to the local authorities (in SoSh) :

Hargeysa	40	Boorama	about 150
Gebiley	70	Berbera	100

4.3.3 HIDES AND SKINS TRADE

As has already been stated, the collection of hides and skins is the monopoly of the Hides and Skins Agency, which is then responsible for marketing them.

4.3.3.1 Collection

The Hargeysa branch is responsible for the entire North West region. However, it would appear that it operates very little if at all in the Saylac and Lughaye districts, where skins are sent directly to Djibouti. The amount of skins exported in this way could not be known.

The Agency has some twenty employees whose job is to collect dried skins from the bush areas. These employees also provide information on how to improve the quality of the skins. Hides and skins of slaughtered animals bought from the butcher are hung up to dry in drying sheds near the abattoirs, which are supervised by the Hides and Skins Agency. The Agency collects about 730 000 skins and hides a year, and its activities, which depend on the level of off-take in the herds (slaughtering and exports), are relatively stable, with even a slight increase each year.

Table 4.3.(4)

SKINS COLLECTED AT HARGEYSA (total number)			
1976	622 771	1978	730 618
1977	727 308	1979	740 478

Source : Hides and Skins Agency.

The districts which provide skins are, in decreasing order, Hargeysa (with more than 75 % of the skins), Gebiley, Boorama and Berbera. It also appears upon analysis that the Agency collects some skins from Ethiopia, which would explain the quantity of activity, especially in the border districts of Hargeysa and Gebiley.

It would seem that the hides of cattle and camels have only been collected from abattoirs by the HSA since 1979. Yet, statistics were available. Their collection remains marginal in so far as the hides are traditionally used for domestic purposes.

4.3.3.2 Processing

There are two industries for treating hides and skins at Hargeysa:

. the Hides and Skins Industry, which produces pickled skins for overseas markets;

. the Botun tannery, which was opened in mid-August 1978, and which produces leather for the local market.

Both of these obtain their supplies from the Hides and Skins Agency, which has also a monopoly of distribution.

The Hides and Skins Industry only treats skins while the Botun tannery tans hides, mainly of camels, and occasionally cattle. This tannery, which is a private company, can treat a minimum of 1500 hides a month. At the moment, it too is faced with technical difficulties and is only running at a third of its capacity.

This state of affairs prevents the development of other activities such as the installation of a shoe factory to supply the local market which could bring more added value to the sector.

Table 4.3 (5)

PROCESSING OF HIDES AND SKINS
(total number treated per year)

	Hides and Skins Industry (pickled skins)		Botun tannery	
	Annual	Monthly average	Annual	Monthly average
Capacity	1 400 000	120 000	18 000	1 500
1978 (6 months)	61 847	10 300	1 698	283
1979 (3 months)	31 620	10 540	4 227*	352
1980 (3 months)	(...)	(...)	1 883	628

* 62 zebu skins were also tanned.

Source : Hides and Skins Industry - Botun tannery.

If the conditions in which these two companies are operating continue beyond the year 1980 (very irregular water and electricity supply, uncertain supply of chemicals from abroad) the risk is high to see their activities placed in jeopardy.

Actually the Hide and Skin Factory was no longer operating in 1981.

PRICES QUOTED FOR LIVESTOCK
(March 1980)

		Delivered to Djibouti (FD)	Price Pastoralis 'S
Sheep		7 000 (240 SoSh)	
Goat			200 (4
Cattle			a
Male	2 years	-	
	4 years	-	2 ( )
	5 years	-	3 (
	Older	-	2 (
Female	3 years	-	
	Sterile	-	
	Thin, older animal		
Camels	2-3 years	-	2 0
	4 years	70 000 (2400 SoSh)	4 000
	8-9 years	90 000 (3100 SoSh)	6 000

1000 FD = $5.65 = 34.25 SoSh at the official rate.
Source : enquiries carried out among breeders.

There is no contradiction between the prices charged on the Djibouti market and those in Somalia, as account must be both the "franco valuta" system and the unofficial exch by which the Somali shilling is reduced in value by abo

This situation should modify as a consequence of the mon which took place in the second half of 1981

4.4.1.2 Market prices

In addition, the market prices collected at the four mair show the average prices charged at two particular times year: end of the rainy season and middle of the dry season

PRICES AT THE MAIN MARKETS IN 1979-1980
(in SoSh)

Species	Hargeysa		Gebiley		Boorama		Ber
	R.S	D.S	R.S	D.S	R.S	D.S	R.S
Cattle	1500	1700/2000	1000	3000	2500	2700	(...)
Sheep/goats	300/350	450	150/300	300/400	350	250	(...)
Camel	3500	3200/4000	2500/5000	5000	3000	3500	(...)

(...) : unknown.
Source : district.

These prices reveal a typical phenomenon of seasonally fluctuating livestock prices, and that is that prices are high in the dry season, which is when there are fewer animals for sale and when good quality animals are rare.

4.4.2 MEAT PRICES

4.4.2.1 Official prices

The price of meat is officially decided by the local authorities. The price per kilogramme officially decreed in the four main centres were:

Table 4.4.(3)

OFFICIAL MEAT PRICES (1980) (SoSh/kg)

	Hargeysa	Gebiley	Boorama	Berbera
Beef	10	20 - 25	15 - 20	60*
Mutton	20	25 - 30	15	
Goat			12	25
Camel	10	15 - 20	15 - 20	13

* Aberrant price quoted by the local authorities.

These prices are rarely respected, especially as meat is rarely sold by weight.

4.4.2.2 Actual prices

A survey carried out in Hargeysa in March 1980 well illustrates the previous observation.

Table 4.4(4)

		Unit	Price in SoSh (March 1980)
Meat	Leg of mutton	kg	40
	Mutton chop	kg	34
	Fillet of beef	kg	30
	Camel	kg	32
Offal	Ox brain	u	3
	Ox tongue	u	30
Chicken		kg	60

4.4.3 PRICE OF MILK AND EGGS

It is very difficult to obtain eggs on the local market. There may be a taboo connected with their consumption. The price is very high (3 SoSh per egg in March 1980) and foreign residents are almost the only people who buy eggs. Any large egg-producing establishment would be totally dependent on foreign markets.

Milk is sold almost exclusively on a door-to-door basis. In 1980 when milk was plentiful, the price stood at 10 SoSh per liter, and this doubled in the dry season. For several months of the year, no milk is available at Hargeysa.

4.4.4 PRICE OF HIDES AND SKINS

4.4.4.1 Hides and Skins Agency prices

The prices paid for skins are based on a scale of quality which distinguishes four categories. Cattle hides are paid for by the kilogramme, and camel hides per unit.

Hides and skins sold to the processing industries are graded according to the same scale.

Table 4.4(5)

HSA BUYING AND SELLING PRICES FOR HIDES AND SKINS
(1980) (in SoSh)

		Buying price	Selling price
Sheep/goat	Grade 1	9	13.5
	Grade 2	6.5	11.5
	Grade 3	4	8.5
	Grade 4	1	6.5
Cattle (kg)		1.5	-
Camel (unit)		12	20

The hides and skins collected by the Hides and Skins Agency are generally of medium grade. However, the Agency only sells products of high quality to the processing industries. According to the information obtained, the price of hides in Djibouti is very attractive and it is for this reason that so many hides and skins are sent over the border from the Saylac and Lughaye districts.

4.4.4.2 Processed products

The Hides and Skins Industry does not sell its products on the domestic market. In March 1980, the Botun tannery sold tanned hides on the local market for between 18 and 20 SoSh per kg.

4.5 LIVESTOCK EXPORT

4.5.1 MOVEMENT OF LIVESTOCK

4.5.1.1 Main circuits

Livestock is exported via three main circuits, as follows:

towards Saudi Arabia, and occasionally other countries of the Arabian peninsula, by sea. More than 80 % of officially recorded gross exports (in number) pass through the port of Berbera;

. towards Kenya, over the Somalia-Kenya border;

. towards Djibouti, which borders the North West region.

In general, the export figures do not specify the number of animals exported which are in reality in transit.

In addition, the statistics concerning movement over the borders with neighbouring countries (Kenya, Djibouti, Ethiopia) are very sketchy and not very reliable. There is no other way of knowing the number of animals moved in this way, especially the number entering the country from Kenya or Ethiopia and crossing through the North West region. The only way of discovering this would be to carry out a survey on the markets and among the exporters. The present analysis therefore only concerns officially recorded exports.

Table 4.5(1)

OFFICIALLY RECORDED EXPORTS OF LIVESTOCK

Year	Cattle		Sheep		Goats		Camels	
	Head	%	Head	%	Head	%	Head	%
1974	31 472	100	663 100	100	575 348	100	23 965	100
1975	39 883	127	793 102	120	743 059	129	34 223	143
1976	58 335	185	384 692	58	382 106	66	33 502	140
1977	56 720	180	465 005	70	461 295	80	33 278	139
1978	76 982	245	738 843	111	624 771	108	21 580	90
1979	67 886	216	746 907	113	705 268	122	12 508	52
1980	62 744	199	1 129 704*			91 *	3 862	16

* 1 129 704 = S + G = 91%

Source: Livestock Development Agency.

Table 4.5(2)

DESTINATION OF ANIMALS EXPORTED
(%)

	Saudi Arabia		U.A.E		U.S.S.R		North Yemen		Others	
	1977	1978	1977	1978	1977	1978	1977	1978	1977	1978
Cattle	96.6	98.7	2.0	0.8	0.4	-	0.1	-	0.9*	0.5***
Sheep	91.4	93.1	0.1	6.8	7.7	-	0.7	0.1	0.1**	-
Goats	90.8	92.4	0.1	7.5	7.8	-	1.2	-	0.1**	
Camels	100	(...)	-	(...)	-	(...)	-	(...)	-	(...)

(...) : no information available.

* Oman ** South Yemen *** Kenya

Source : State Planning Commission - Foreign trade statistics.

Table 4.5.(1), which gives export figures for livestock since 1974, a drought year, clearly shows:

- a very rapid increase in the exports of cattle; this can be explained by three more or less contradictory phenomena, which cannot be fully distinguished:
  - reconstitution of the national herd;
  - overexploitation of the national herd due to increasing demand;
  - growth in the number of animals in transit;
- relative stability in the exports of sheep and goats in years when there were normal weather conditions;
- very noticeable reduction in the number of camels exported, which can be explained and justified by changes in the pattern of requirements of traditional importers.

Analysing these statistics in terms of the countries of destination shows that practically all the animals exported in each category go to Saudi Arabia.

4.5.1.2 Exports from Berbera

In the North West region, exports from the port of Berbera* follow the circuits described above, with the most important routes passing through Tog Wajale and Qool Cadday. All administrative procedures, other than embarkation procedures in the proper sense, are carried out at Hargeysa, in particular the obtaining of letters of credit.

Table 4.5.(3)

LIVESTOCK EXPORTED VIA BERBERA						
	1978			1979		
	Sheep and goats	Cattle	Camels	Sheep and goats	Cattle	Camels
Berbera	1 190 972	58 440	16 570	1 322 656	54 720	9 713
Percentage of total exported livestock	87.3	75.9	76.8	91.1	80.6	77.6

Source : Foreign trade at Berbera - Ships' logs - Livestock.

* The number of animals leaving for Djibouti is not known.

It will be noticed that more than 80 % of the exported livestock officially registered by the LDA passes through the port of Berbera. In 1978, this represented more than 80 % of the livestock exported from the country in terms of value. On the basis of information gathered at Hargeysa, it would seem that the majority of export licences are granted at Hargeysa rather than at Burao, the other "departure point" for Berbera.

The records do not state where the animals come from, and there is therefore no way of knowing how many are exported from the North West region, nor the net figures after the animals in transit from Ethiopia have been substracted.

The number of requests for export licences was 578 in 1978 and 473 in 1979. This represents an average of 3.2 shipments per exporter in 1979.

4.5.2 CONDITIONS AND LIMITING FACTORS CONNECTED WITH EXPORTS THROUGH THE PORT OF BERBERA

4.5.2.1 Export conditions

Animal health

The animals for export are in theory vaccinated systematically against rinderpest, anthrax and CBPP, or caprine pleuropneumonia, and they must by placed in "quarantine" (for a total of 14 days). These two operations are carried out at the "departure point", ie. Hargeysa in the case of the North West region. The LDA checks the animals prior to embarkation and delivers a health certificate.

As was seen in chapter 2, most of the vaccinations carried out by the Department of Animal Health (MLFR) are in fact given to livestock intended for export. However, sometimes certain vaccinations are not given, due to the lack of supplies of vaccine. For this reason, the LDA had opened a holding ground at Qool Cadday where animals can be left for a daily charge of 20 cents for sheep and goats and 60 cents for cattle and camels.

Administrative and financial procedures

To become an exporter, it is necessary to obtain a "general licence" of exporter-importer from the Ministry of Commerce which costs an initial 30 SoSh and an annual 300 SoSh thereafter paid to the Chamber of Commerce.

As exports are officially controlled, every recognised exporter must request permission from the Ministry of Commerce before sending any shipment. The Ministry opens a file and delivers a letter of credit for payment. Expenses incurred are minimal, amounting to only 37 SoSh (3 Sh for the file and 34 Sh for stamps).

The amount of money advanced by the financial institutions is calculated for each shipment anticipated, and the reference prices per head are as follows:

- $US 53 for sheep and goats;
- $US 280 for cattle;
- $US 450 for camels.

These advances, which must be repaid in foreign currency, just cover the current purchase price of the animals. In these circumstances, the importing of goods which is allowed by the system of "franco valuta" is a rewarding form of compensation, with further profits deriving from the practice of exchanging currency outside the official circuits.

These regulations were to be modified during the year 1981.

Embarkation taxes and other costs

In 1980, at Berbera port, the exporter was required to pay the following duties and taxes:

Table 4.5.(4)

EXPORT DUTIES AND TAXES PER HEAD AND PER SPECIES AT BERBERA IN 1980
(in SoSh)

	Sheep/goats	Cattle	Camels
Taxable value	100	450	900
National tax	7	37	75
Harbour dues	1.5	6.75	13.5
L.D.A.	2	10	10
Enclosure fees	0.8	5	6
Customs duties	2	10	18
Revenue stamp	2	2	4
Total	15.3	70.75	126.5

In addition, the exporter must ensure that the animals are properly looked after before embarkation and during the crossing*.

4.5.2.2 Constraints

There are numerous constraints affecting the export of animals, both from the point of view of organising the shipment as well as the technical conditions involved and the expenses thus incurred.

Organisation of shipment

Because of environmental and weather conditions in Berbera is only possible to keep animals waiting in the town long enough to complete embarkation formalities. Shipments are of various sizes and often number more than 2000 or 3000 heads in the case of small ruminants, and several hundred in the case of cattle. One of the major constraints is linked with shipping. Boats leave at irregular intervals, and often do not conform to Saudi regulations with respect to livestock transport equipment, and shipments are badly scheduled with respect to the amount of space available on the boats.

This constraint is likely to be alleviated due to the creation in 1980 of the Somali Shipping Company, which should possess seven vessels equipped to transport livestock on a regular crossing basis (approximately every ten days).

With regard to the scheduling of shipments, in particular during the peak period, exporters have organised themselves and created the Committee of Livestock Dealers, which gives each exporter a position in line for the shipment of a particular convoy. Without being perfect, the system is proving to be efficient. Amongst other things, it has the advantage of regulating trading conditions better, both in respect of collection and of the prices charged and expenses incurred (waiting, transport).

Technical constraints

The other constraints concern essentially the conditions in which animals are looked after in the different installations; holding grounds around Hargeysa, quarantine enclosure at Berbera, and harbour infrastructures connected with embarkation procedures. All these infrastructures are either unfinished (Qool Cadday) or in a poor

* The waiting period is in general 5 days. In 1980, depending on the season, taking care of 1000 heads of small ruminants can most between 3000 and 5000 SoSh. It is also necessary to reckon 3.5 SoSh per head for fodder during transportation (1 sheep or goat = 0.16 zebu = 0.1 camel).

Table 4.5(5)

IMPORTS OF LIVESTOCK INTO SAUDI ARABIA*
(number of animals)

		1974	1975	1976	1977	1978
Sheep/goats	Somalia	1 020 000	1 230 000	660 000	820 000	1 350 000
	Sudan	200 000	170 000	(100 000)	(280 000)	400 000
	Others	100 000	(...)	(300 000)	(500 000)	650 000
Cattle	Somalia	22 000	39 000	55 000	54 000	55 000
	Sudan	8 000	(11 000)	(15 000)	(15 000)	20 000
	Others	(43 000)	(35 000)	(37 000)	(11 000)	25 000
Camels	Somalia	24 000	34 000	34 000	33 000	18 000
	Sudan	3 000	6 000	5 000	5 000	5 000
	Others	-	-	7 000		7 000

( ) estimated
(...) unknown
* Figures rounded off to nearest thousand.
Source : World Bank Report - 1978

It will be noticed that between 1974 and 1978, the pattern of imports altered to the detriment of Somalia, except in the case of cattle. Thus in 1978, only 56 % of imported sheep and goats came from Somalia, as against 77 % in 1974. In the same period, the percentage of camels imported from Somalia fell from 89 % to 60 %. On the other hand, cattle, which represented only 30 % of the market in 1974, increased to 56 % in 1978. It is only in the case of camels that there is an absolute regression, with the number falling quite considerably. In the case of sheep and goats, the number of animals imported in 1978 is an absolute record.

As a conclusion, the market for small live ruminants is developing rapidly in Saudi Arabia. In 1979, it reached 3 million heads, and the demand has been essentially to the advantage of Australian suppliers while Somali exports have remained stable in relative terms.

4.5.3.2 Prospects

Livestock exports

Increasing revenues in Saudi Arabia have brought about a change in the consumption patterns, which in turn has resulted in an increase in demand. This market will thus have a predominant place over the coming years. However, on the basis of the preceding observations, it is the pattern of exports which will be changed. A real problem will be posed in finding outlets for camels, which provide second quality meat.

In addition the expansion of the meat market (fresh, chilled or frozen) is mainly satisfied through the imports of carcasses which multiplied by 8.6 in terms of tonnage between 1974 and 1978 (and 12.9 in the case of red meat).

On the other hand, if the effects of drought are not too severe, the exports of cattle and small ruminants should increase, or at least stay at the same level as at present, in conditions which are favourable for exporters, especially as Somali meat in these two categories has a high reputation. With regard camels, one should expect stagnation or even regression.

New markets should be explored for the export of young camels (between 9 and 18 months old), or tinned meat for the army, etc.

With the creation of the Somali Shipping Company, in 1980 Somalia now meets Saudi requirements. The anticipated improvements in infrastructures and better health conditions which up to now have not constituted any obstacle, should provide an added improvement.

The Committee of Livestock Dealers, aware of the competition from other countries, and the risks posed by the substitution of frozen or refrigerated meat, has set itself the aim of finding other markets. Prospects in the region appear to be limited, but there could be the opportunity of exporting camels to other countries in the Arabian peninsula. In this respect, difficulties could be raised in view of the financial procedures which at present surround this type of trade: payment in foreign currency, and the possibility of buying goods. The World Bank study tends to show that in 1978, exporters had a net average earning of $US 16 per head (sheep and goats) sold on the Saudi market, which they could then use to import goods (by the "franco valuta" system) or else exchange on the open market.

Meat exports

The national government anticipates the construction of an abattoir with cold storage facilities for sending fresh and frozen meat by air from Hargeysa. Saudi Arabia would agree to this as long as the proper guarantee of hygiene was provided, and if the cost price was attractive. However, the economic study was inconclusive and as yet the abattoir is not constructed.

In addition, it was intended to launch a large-scale poultry project at Hargeysa, producing eggs and chickens which would also be exported. This project was to be financed by funds from the Arab states, but appears to be faced with operational problems (supply of feed, water and electricity) and it is not certain that it will be profitable.

4.5.4 HIDES AND SKINS

4.5.4.1 Exported products

Dried skins

The Hides and Skins Agency exports dried skins mainly to Italy and China. In 1979, about 1 100 000 skins were exported from Mogadishu, and of these about 70 % came from the regional branch at Hargeysa.

Pickled skins

The Hides and Skins Agency manufactures semi-processed products, which are exported mainly to Italy and East Germany. The pickled skins are divided in six categories according to quality. In 1979, the average selling price for skins was $US 7.5 per unit. The Hargeysa plant produced about 125 000 skins.

4.5.4.2 Problems involved

It would be to Somalia's advantage to develop its own hides and skins industry, rather than exporting raw or semi-processed products abroad. This industry could be geared to the foreign market, or on the other hand lead to the development of shoe manufacturing, for example which could then replace foreign imports. As a prerequisite, it would appear necessary to overcome the technical difficulties of running the units which already exist, as described above.

The present report does not contain any proposals in the area of marketing, as this is studied in a special programme being carried out by the World Bank.

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Part 3

RECOMMENDATIONS

INTRODUCTION

Animal health and nutrition problems hamper the development of livestock production and productivity in the North West region. Trying to overcome them requires preliminary actions in the field of Animal Health for the prevention of the main enzootic diseases and the control of parasites.

Otherwise, a number of recommendations or project proposals can be thougth of regarding range management and fodder production in the extensive livestock breeding system of production. Intensive production can be better developped in association with agriculture. In that respect, the implementation of dairy camel agro-pastoral farms in peri-urban areas for milk production seems a possibility. As for draft animals improving their nutrition and their power efficiency will contribute to increase the agricultural output.

Finally, the rehabilitation or reconstruction of the livestock marketing facilities would be a complementary action.

Chapter 1

ANIMAL HEALTH

The analysis showed the low efficiency of the Animal Health Services and identified some of the major constraints (lack of means, poor organisation, ...) the Department was faced with, to properly control the epizootic diseases and provide the pastoralists with drugs in number and/or minerals. Two recommendations can be made in this respect:

- one is the rehabilitation of the Health Services and the organisation of annual vaccination campains,

- the other is the creation of a Regional Pharmacy-warehouse placed under the authority of the MLFR but which would be self financed.

The distribution of the common drugs would be in the hands of the private sector, only those dangerous drugs and medecines will be handled by the Department of Animal Health.

Both actions are described in details in the NRDP Phase II Identification Project (Part III Annex 2) for which there are key aspect towards a proper range management programme.

The overall cost for the five regions of the north over five years was estimated at 41.7 million SoSh.

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Chapter 2

RANGE AND FODDER PRODUCTION

2.1 RANGE MANAGEMENT

Under extensive livestock breeding conditions, the development of animal production can be envisaged through the implementation of a range use plan which would fully integrate the four factors: pastoralists, livestock, vegetation and water availability.

Having the confidence of the pastoralits will condition the success of such a programme. This could be done through the granting of exclusive grazing right to pastoral communities. The definition and implementation of a programme is the responsability of NRA. For the North West region this has already been considered and it is included in the NRDP Phase II Identification Project which will cover the five regions of the north.

2.2 RECOMMENDATIONS FOR IMPROVING FODDER PRODUCTION

There are two possible methods for improving the range, one involving the regeneration of degraded vegetation and intended for large areas, and the other involving intensive fodder production, requiring the utilisation of rain water or irrigation.

Finally, in the context of agricultural activities, animal feed could be improved by using crop residues and agricultural by-products as additional feed, or else rainfed fodder crops could be introduced in the fallow areas.

2.2.1 EXTENSIVE RANGE IMPROVEMENT

Extensive range improvement involves either artificial sowing or developing a range management scheme aimed at organising pastoral land on the basis of allocated grazing areas.

These activities form part of Phase II of the Northern Rangeland Development Project, which also covers the North West Region. They are thus the responsibility of the National Range Agency.

2.2.2 INTENSIVE FODDER PRODUCTION

Intensive fodder production can easily form part of a joint agricultur stockbreeding scheme, with the fodder being produced on fallow land and thus providing on the one hand nitrogen for the soil (leguminous plants) and on the other fresh, good quality feed for working animals.

Due to the low rainfall, crops of this kind will need additional water supplies. These can be provided either by water harvesting, flood spreading or irrigation.

2.2.2.1 Water harvesting

This technique, which is widely used in the North West, consists in collecting the runoff which forms during rainy periods. It involves constructing bunds on the slopes in question, or, as is preferable, developing the low lying areas which already collect the runoff naturally.

Such sites should be located on the basis of strict criteria, such as the existence of cultivable land and the known topography, rainfall and runoff coefficients in the area. The relation between the cultivated area and the area of the catchment must be evaluated to determine if the quantity of water provided will be enough for the crops.

One aim may be to maximise production during the month of May, when the level of rainfall is amongst the highest. It is assumed that rainfall during April and the ensuing runoff will have been sufficient to make up for the soil moisture deficit in the sector under cultivation.

In order to compensate for monthly ETP, 220 mm of water are required. Precipitation amounts to 58 mm on average. Planning for 50 mm rainfall and assuming 15% runoff for the month, there will thus be 7.5 mm runoff. In order to reach the 170 mm required (220 mm requirements less the incident rainfall), the ratio of catchment to cropped area will need to be more than 20 to 1.

With 20% runoff and 60 mm precipitation for the month, the ratio drops to about 15 to 1. A value of 20 to 1 seems to be a basic average to be taken into account in looking for suitable sites.

In the event of fodder crops being grown on fallow land, it would be wise to envisage growing leguminous plants rather than grasses (this would avoid regrowth the following year and would supply nitrogen for the soil).

An experimental programme should thus be prepared and put into effect as soon as possible in order to select the species which are best suited to local conditions and requirements. This kind of activity could be undertaken in the framework of the experimental farm. The following species could be sown:

	Moisture requirements (mm)	Palatability (1)	Rate seeding (kg/ha) (2)
Medicago sativa	450	+++	15/5
Medicago tribuloides	300	+	-/2
Medicago trunculata	300	+	-/2
Melilotus officinalis	400	+	-/1
Melilotus alba	450	+	-/1
Stylosanthes gracilis	>100	++	3/1
Stylosanthes guyanensis	>100	++	3/1
Trifolium histum	300	++	20/2
Trifolium repenslatum	600	+++	6/2
Vigna sinensis	600	++	-/10

(1) +++ very high - ++ high - + good .

(2) The first number is the rate if sown alone.
The second number is the rate if sown mixed.

2.2.2.2 Flood spreading

This method is more difficult to envisage due to the high cost of the works involved. However, it could be of interest in the coastal plain area, where numerous toggas discharge their flow (for example the togga Waheen near Bulhar).

The use of high yield species, well adapted to the very hot, dry climate, would enable fodder production centres to be developed near Berbera and thus provide additional feed for animals awaiting shipment from the port. A programme of this kind should be studied in detail as part of the NRDP.

2.2.2.3 Irrigation

It is not possible to envisage producing fodder in the plateau area using water from boreholes due to the production costs involved. However, in the coastal plain, a fodder substratum could be associated with the date palm plantations, using good quality species which are able to resist the heat. Atriplex coriacea has already been tried out at the Bihan Gaha station (10°27' N, 45°37' E). Other species are already cultivated in Tunisia and are giving excellent results: Atriplex nummularia and Atriplex halimus.

2.2.3 RAINFED FODDER PRODUCTION

This would consist of developing large zones which were initially used for the cultivation of rainfed crops and which have been left fallow over the last few years due to the lack of rain.

These sectors could be developed by reseeding with local species which are well adapted to long periods without water. In this case, simple ploughing or harrowing followed by seeding would be sufficient and in this way, additional grazing areas could be provided for village animals.

2.2.3.1 Grasses and leguminous plants

The following species might be envisaged:

a) Grasses

Sprobolus ruspolianus
Cenchrus ciliaris (Buffle grass)
Chrysopogon aucheri var. quinqueplumis
Cynodon plectostachys
Enteropogon macrostachys
Chloris gayanus
Lasiurius sp.

b) Leguminous plants

Dolichos lablab
Macroptilium atropurpureum
Dolichos biflorus
Vigna sinensis (cow peas)

In this last case, after the grain has been threshed for human consumption, the straw is stored for the livestock. These fodder plants could be associated with or completed by shrubs or cacti.

2.2.3.2 Leguminous shrubs

a) Prosopis juliflora

Planted at three metre intervals, this leguminous shrub produces pods which are cropped by the livestock, and the foliage may be pruned and used for the animals (one quarter of the crown each year). The seeds are first treated in warm water and 2 or 3 are planted in each growing bag in September-October. The seedlings are planted out when the first rains arrive (March-April).

b) Acacia sp.

Several types of acacia have already proved to be valuable fodder plants in other semi-arid areas: Acacia salicina, Acacia ligulata, Acacia nilotica var, indica. and Acacia aneura are all species which could be developed in the North West.

c) Leucaena leucocephala

This leguminous shrub adapts to numerous situations and is able to withstand drought conditions well. It is very widely used at the moment for mixed production purposes (fodder, fire-wood, organic fertiliser).

These shrubs could be planted as wind-breaks between the sorghum and maize fields. They are particularly well suited for this as their foliage is dense and grows down to ground level.

2.2.3.3 Fodder cacti

There are almost 300 species in the genus Opuntia, many of which have already been tested. Opuntia cacti already exist in the North West. At Hargeysa, many hedges consist of Opuntia ficus indica (spineless), Opuntia bergeriana (spiny type) and Opuntia ficus indica var. amylacea, which is not very productive and not very much sought by the animals, but which can be used to form good protective hedges.

Near Bown, one particular species, Opuntia bergeriana (sub-spineless type) is in the process of invading the Acacia bussei and Acacia etbaica open scrubs (see ecological map). This species appears to have been introduced from Ethiopia, which is quite close, by baboons who feed on the fruit or by floods on the smaller toggas. However, the production of this species is quite low, and, because of the glochids (small hook-shaped spines) covering the joints, it is difficult to handle and not very much eaten by animals (apart from camels and goats).

The spiny type of Opuntia bergeriana, which can be found in certain places around Hargeysa, is poisonous, and must be carefully controlled in order to prevent it spreading.

The introduction and cultivation of spineless varieties therefore appears to be possible in the entire plateau region. In the Sertao region of north east Brazil, where the ecological conditions and type of vegetation are very similar to those in North West Somalia, the stock-breeding industry is partially based on the cultivation of fodder cacti in an area covering 300 000 ha. Annual production per hectare reaches as much as 100 to 200 tonnes. The main varieties

cultivated are Opuntia ficus indica var. inermis, Opuntia inermis and Nopalea cochenillifera. The following species could also be introduced into the North West and cultivated on a trial basis:

- Opuntia undulata (completely spineless);
- Opuntia megacantha (spineless);
- Opuntia fusicaulis (spineless).

Production techniques

Planting is simple and consists of pricking out cuttings of joints at the start of the rainy season. The cuttings, which must be more than a year old, should be left at least a week between cutting and planting (in order to allow the scar to heal and prevent any risk of rotting). The soil must be deep, and needs a good slope to favour runoff, and any areas which are flooded or waterlogged for several days are to be avoided.

The cuttings are planted in lines, with an optimum density of 20 000/ha, the joint enclined at an angle of about 60° and the scarred base burried in about 15 cm of earth.

The cacti may be exploited two or three years after planting, and cutting may take place every year or two years. Yields can reach 100 tonnes/ha and be increased by 50% with an addition of 10 tonnes of manure/ha.

The joints collected have about the same fodder value as maize silage, but the dry matter content is less (10-15% as against more than 20%). This high water content may cause diarrhose; it is for this reason that daily consumption should not exceed 25 kg fresh weight per animal. The rest of the feed is to be provided in the form of hay (leguminous plants or grasses).

2.2.4 LIST OF THE MAIN SEED SUPPLIERS

- The Australian Estates Co. Ltd.
  GPO Box 216
  Brisbane 4001 - Australia
- Director C.A.Z.R.
  Todhpur - India
- Wright, Stephenso & Co Pty. Ltd.
  Po Box 302
  Victoria - 3031 Honey Ponds - Australia

. South Australian Seed rowers Coop.
Po. Box 461 GPO
Adelaide, South Australia 5061 - Australia

. Westralian Farmers Coop Ltd.
Wellington Street
Perth - Australia

. Messrs Arthur Yates & Co Pty
Po. Box 117
Rockhampton - Queensland - Australia

. Kenya Seed Co
Po. Box 553
Kitale - Kenya

. Genest & Co
27, rue Pierre Delore
69371 - Lyon Cedex 2 - France

For other seed suppliers see:

. "World List of Seed Sources"
E. Sgaravatti
AGP - SIDP 78/18 (1st draft)
FAO - Rome - 1978

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Chapter 3

LIVESTOCK PRODUCTION
ANIMAL HUSBANDRY

3.1 DRAFT ANIMALS

3.1.1 PROBLEMS ENCOUNTERED ON THE FARMS

Under present farming practices, only crop by-products and residus are available for feeding draft animals.

These by-products with very little protein content have a poor nutritional value.

Improving the feeding of draft animals will increase their drafting power and therefore will contribute to a better cultivation of the land.

The additional food stuffs which appear necessary from a first diagnosis are:

- bran produced from the family grain consumption,
- grain,
- harwested fodder, foliage, haulm or acacia pods.

All these products can be produced on the farm.

Urea with 42% nitrogen content added to these food stuffs will partly compensate the nitrogen deficit.

This could be still better improved through the introduction of new crops on the farm the effects of which will be beneficial to both agriculture and livestock thus favoring a greater integration of these two activities.

One can envisage:

- the planting of fodder trees and fodder bushes (like Acacias or Atriplex) along strips which will also serve as wind-breaks for the different crops,

- the introduction of a fodder production in the crop rotation such a scheme should be tested in the experimental farms.

Feed requirements depend on the productive cycle of the animal. According to the observations done in the field, and considering the different needs and increase in productivity (resulting from an improved nutrition and the introduction of adapted implements) some asumptions were made with respect to the food requirements and the different type or rations. It was also assumed that the oxen would receive additional feeding for 100 days by the end of their productive cycle in order for the farmers to get the greater return on the market by selling fat animals.

Total cycle for oxen:

- Training age: 3-4 years
- Working cycle: 3 years
- Fattening cycle: 3 months
- Selling age: 6-7 years

In each year, it was also assumed that animals would be utilised on the farm as follows:

- light work (transport): 25 days
- regular farming works: 40 days
- heavy duties: 25 days
- resting period: 275 days

This schedule allows for draft work outside of the individual farm.

Consequently in these basis, total food requirements have been estimated

FEEDING REQUIREMENT			
Period	Fodder unit	Digestible nitrogenous subtances (grams)	Number of days
Maintenance	2.7	190	275
Light works	4.0	200	25
Regular works	5.4	210	40
Heavy works	6.8	220	25
Pre-sale period	2.9	315	100

Live weight: 320 kg .
Feeding potential: 8 to 10 kg DM/day.

3.1.2 RATIONS

Different types of daily rations have also been calculated (table 3.1(2)) as an indicative guide line for the definition of a pilot farm. Their composition will be subject to modifications when more informations will be known from the different crop experiments and when adapted farming systems will have been identified.

3.1.3 SIDE MEASURES

The quantity of urea given in the rations is the maximum the animals can tolerate.

It should be mixed to the other food stuffs and its distribution done at 3 different time in the day.

In addition fluke worm treatments should be carried out twice a year.

The digestibility and palatability of the ration can be improved when the stalks are chopped and then covered with a mineral supplement-powder 22 kg per year.

At the end of the dry season stalks will be soaked first.

It is important that animals have a small enclosure a trough and a shed.

3.2 CAMEL DAIRY AGRO-PASTORAL PILOT FARMS

A project entitled 'Hargeysa Farm' is intended to satisfy the needs for cattle dairy products in the area, and to supply breeders with young animals. The pastures required have been estimated at 5000 ha, of which 200 would be used for growing fodder crops. The total cost would be 7 010 000 SoSh.

The type of farm envisaged, managed by the public authorities, would not seem to make use of traditional stock-breeding methods.

On the basis of the principles that local cattle and camel stock-breeders already produce milk, and that the large and small towns need to be supplied with dairy products, it is interesting to study the possibility of dairy production for the urban areas from these local herds, preferably camels (see § 1.3.3 Part 2).

Camel milk production will be conducted in pilot agro-pastoral farms associating migratory herding to other rural activities.

Table 3.1(2)

INDICATIVE DAILY RATIONS FOR OXEN IN EACH PERIOD

Product		Gross matter	DM (kg)	FU	DNS (grams)	Total annual requirement for 1 team losses included (kg)
MAINTENANCE (275 days)						
Ration 1	Maize stalks	4.6	4.0	1.07	55	2 800
	Sorghum stalks	5.2	4.0	1.20	-	3 200
	Acacia leaves (dry)	0.7	0.61	0.43	46	400
	Mixed urea (42% N)	0.03	0.03	-	89	17
	Total	10.53	8.64	2.70	190	6 417
Ration 2	Maize stalks	5.0	4.3	1.16	60	3 000
	Sorghum stalks	5.0	3.9	1.18	-	3 000
	Maize bran	0.5	0.4	0.44	37	300
	Mixed urea (42% N)	0.035	0.03	-	93	19
	Total	10.53	8.63	2.78	190	6 319
DRAFTING PERIODS						
Ration for light works (25 days)	Maize stalks	1.0	0.9	0.23	12	60
	Sorghum stalks	6.5	5.0	1.50	-	360
	Sorghum bran	2.7	2.5	2.11	211	140
	Total	10.2	8.4	3.84	233	560
Ration for regular works (40 days)	Maize stalks	2.6	2.0	0.60	-	120
	Sorghum stalks	2.3	2.0	0.53	28	110
	Maize bran	4.8	4.2	4.26	359	200
	Total	9.7	8.2	5.39	387	400
Ration for heavy works (25 days)	Sorghum stalks	2.6	2.0	0.60	-	120
	Maize grain	2.3	2.0	0.53	28	110
	Sorghum grain	4.8	4.2	4.26	359	200
	Total	9.7	8.2	5.39	387	400
PREPARATION FOR SALE (100 days)						
Maize stalks		2.5	1.9	0.58	-	550
Sorghum stalks		4.2	3.6	0.98	51	900
Acacia pods		0.7	0.6	0.57	95	80
Sorghum bran		1.0	0.9	0.78	82	210
Mixed urea (42% N)		0.03	0.03	-	89	17
Total		8.4	7.00	2.91	317	1 757

3.2.1 MAJOR CONSTRAINT

The lactating cycle for a camel in an extensive herd is 2 years. This conditions the functioning of camel dairy agro-pastoral farms.

Consequently a female shall be introduced into the farm 1 month before giving birth for a period of 8 months. Then daily milk production will be maximum and these would be a permanent rotation of milking females. Besides, female returning into the migratory herds will adopt young camels (of 6 months) born on the farm.

3.2.2 ORGANISATION OF THE PILOT FARMS

On the farm, milking camels would be kept in permanent open housing inside a lay enclosure receive their food ration in a trough. Water and a mineral complement would be serviced at libitum.

On the farm, camels will be treated when necessary against external parasites.

Otherwise, there will be only individual animal health care whenever required. Meanwhile the migratory herd should be treated against, internal parasites twice a year, and external parasites every week during the rainy season and according to the needs in the other periods. For that purpose the farmers should be equiped with sprays.

It should also be vaccinated against anthrax and black quarter.

Newly born camels will suck their mother for two days before being separated from them. Then the female will be milked 3 times a day and for 6 months all the milk production will be marketed in urban areas. After that period, the female will adopt newly born camels (1 to 2 weeks)* and return with the migratory herd.

Seven milking females will be kept permanently on the pilot agro-pastoral farm.

The camel population will vary throughout time:

- 14 females plus 7 to 14 young camels for 1 month at the beginning of the production cycle,
- 7 females for 5 months.

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* For this, the young camel and its adoptive mother have to be driven together in the bush, the adoption takes place over night. This is a common practice in Mauritania. Failure are seldom. In case this would happen there, the young camel will be fed in the farm until the age of 6 months and then leave with its mother.

3.2.3 FOOD REQUIREMENTS AND FOOD RATIONS

The food requirements have been maximised for further security sake in the calculation of the ration. Few experiments have been conducted with camels.

Table 3.1(3)

INDICATIVE TYPE OF RATIONS FOR THE FEMALE CAMELS WHILE ON THE FARM				
	Gross matter (kg)	Dry matter (kg)	FU	Digestible nitrogen MAD (grams)
RATION 1: for a female camel at the end of its pregnancy				
. Agricultural by-products or fodder	13.15	12.23	3.67	-
. Rumen content	29.28	4.10	1.64	414
. Acacia dry leaves	0.02	0.02	0.01	3
Total	32.45	16.35	5.32	417
RATION 2: for a milking female camel				
. Agricultural by-products or fodder	17.7	13.67	4.10	-
. Rumen content	63.4	8.87	3.55	396
. Acacias leaves	0.1	0.09	0.07	13
Total	81.2	22.53	7.72	909

In these rations acacia leaves can be replaced by acacia.

Table 3.1(4)

INDICATIVE FORMULA FOR A MINERAL POWDER SUPPLEMENT			
Type I formula		Type II formula	
Product	Quantity (kg)	Product	Quantity (kg)
Bone powder (de-gelatinized)	35	Bicalcic phostate	30
Kitchen salt	30	Kitchen salt	30
Crushed shells	30	Calcium hydroxide	35
Magnesium sulfate	5	Magnesium carbonate	5
TOTAL	100	TOTAL	100

. Live weight (kg) { Female: 514 / Young at birth: 52 }

. Energetic requirements in FU/day:

- Maintenance: 0.8 FU/100 kg live weight/day
- Pregnancy: 1.2 FU/day during the 3 last months
- Lactation: 0.36 FU/liter produced
- Growth, fattening: 0.3 FU/100 g of average daily weight gain

. Proteic needs

- Maintenance: young camel: 0.7 g/kg of live weight; adult camel: 0.6 g/kg of live weight
- Growth: 50 g
- Pregnancy: 90 g of DNS per additional FU
- Lactation: 55 g/liter of milk produced.

. Total individual daily intake: 5.2 kg of DM/100 kg of live weight

3.2.4 DAILY FEEDING REQUIREMENTS

In the pilot farm daily feeding requirements per head will come to:

. 5.32 FU and 416 g of DNS for a female at the end of its gestation,

. 7.72 FU and 908 g of DNS for a female producing 10 liter of milk/day.

Most of the requirements could be covered with the provision of dry fodder and stalks.

The addition of some foliage or pods or else haulms from a leguminous plant would bring the necessary proteins. Also, in peri-urban dairy farms paunch content collected from the abattoir will cover part of the proteic needs.

In addition, a mineral supplement will be serviced ad libitum to the milking camel in the farm.

The total daily fresh food requirements on the pilot dairy farm will amount to 700 kg of fresh product during the first month and 480 kg in the 5 other months *.

* This is equivalent to the rumen content of 5 large animals (including losses)

Most of the other food stuffs would be bought from dealers*. A fraction of the ration could most likely be obtained immediately from the farm like hay or foliage. Later, additional fodder production could be provided by fodder trees, leguminous plants or forage planted or cultivated on the farm.

Total requirements of dry food (losses included for one cycle and 7 lactating female camels have been estimated at:

- 30 tons of fodder or stalks,
- 155 kg of dry foliage or pods,
- 37 kg of mineral complement.

Out of this needs, it is assumed that the farm production will provide 3 tons of fodder and all the foliage or pods. Therefore the dairy farmer will have to buy for each cycle (7 females for 7 months):

- 28 tons of fodder,
- 37 kg of mineral complement,
- 88 tons of rumen content.

3.2.5 MILK PRODUCTION - FARMER'S REVENUE

In each 6 month cycle, 12 600 liters of camel milk would be brought for sale to Hargeysa. Production price, assuming milk availability will increase rather rapidely has been estimated between 6 and 6.5 SoSh**.

Therefore, assuming the following expenditures, the farmer's gross margin (labor cost not included) can be estimated at:

Expenditures (labor cost not included):

. 30 t of fodder at 3 SoSh/FU	30 900 SoSh
. 37 kg of mineral complement at 5 SoSh/kg	185 SoSh
. 88 t of rumen content at 250 SoSh/kg of fresh product	17 600 SoSh
Veterinary products (dairy camels and migratory herd) lump sum	1 500 SoSh
. Depreciation for small equipment	350 SoSh
Total	50 535 SoSh
Gross income: 12 600 l x 6 SoSh -	75 600 SoSh
Gross benefit for one cycle	25 065 SoSh

Annual gross benefit: 50 130 SoSh.

* Priced at 6.6 SoSh/FU during Hadj in 1981, and 3 to 4 during the rest of the year.

** Current price on the market in 1989, varied between 10 to 15 SoSh.

Valued at 6.5 SoSh/liter, annual gross benefit would amount to 62 730 SoSh.

In other words, the dairy farmer's gross benefit on each liter of camel milk produced will vary between 1.99 SoSh/l and 2.48 SoSh/l.

However, this project will have to be experimented first in camel dairy farms. Interested farmers should be given all the necessary assistance and gurantees and have access to farm credit facilities.

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Chapter 4

MARKETING FACILITIES

Since 1966, the organisation of marketing was the responsibility of LDA. In 1981, when the marketing monopoly was abolished for LDA, the NRA became responsible for the management of all export facilities.

In the north, this means both the operation of holding grounds and the Berbera marketing facilities. All of the marketing system needs to be reorganised and reconstructed.

This again is proposed as a component of the NRDP Phase II in the Identification Project Document, in which a coordinated marketing system includes the rehabilitation of the holding grounds on the plateau, the reconstruction of Berbera facilities and also the implementation of a fodder production unit near Berbera.

An indicative budget cost estimate has been also proposed. It concerns the reorganisation of the holding grounds, the building of new facilities at Berbera (both the quarantine and post installations) and the studies related to the creation of a fodder production farm near Berbera.

The total cost has been estimated at 170 million SoSh for a period of five years.

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Chapter 5

ORGANISATION OF A UNIT PRODUCING ANIMAL-DRAWN IMPLEMENTS

In view of the agricultural techniques observed in the North West of Somalia, it is recommended that a unit be set up where animal-drawn implements would be assembled (mechanical assembling and welding).

A unit of this kind, similar to those already installed in West Africa, could produce implements for crop cultivation and post-harvesting operations.

Implements would be assembled in this workshop using templates defined in accordance with the types of agricultural equipment adopted for the region, but which would resemble known models. If this option were taken up, the working parts (ploughshares, hoe blades, springs, etc.) will be imported, as well as the bolts and, possibly, metal sections. The assembly unit could be completely centralised or else consist of a central workshop where the most complicated operations would be performed (such as the bending of parts, for example) while the actual assembly would be carried out by village smiths. The latter would also be responsible for repairing and maintaining the implements.

The basic equipment for the workshop would consist of the following:

- a 30 x 50 m metal clad shed, closed on at least three sides and including an office and stores;
- equipment for cutting, forging, steelwork, welding and general mechanical work, as well as a compressor and generating set.

The investment required to set up the workshop and assembling unit may be estimated at 2.5 million SoSh.

15 staff members would be required, including workmen and technicians plus a technical assistant who could be a U. N. volunteer worker.

By way of example, the workshop could supply the following upon starting operation:

- a frame for a plough body (drawn by oxen or donkeys), or a ridger;

- a triangular tool carrier (or similar) on which rigid or spring tines could be mounted;
- a cart to be drawn by oxen or donkeys.

Examples of the cost prices involved for these implements may be estimated by comparing production at other workshops of the same type (in SoSh):

a) Ox-drawn implements:

. Mouldboard plough (9"):	1100
. Canadian cultivator:	850
. Ridger:	300
. Cart:	3000

b) Donkey implements:

. Mouldboard plough (6"):	900
. Canadian cultivator:	850
. Cart:	2300
. Tumbril:	2700

The production could later be varied to include reversible ploughs, seeders, harrows, drop-side wheelbarrows, etc. The workshop equipment would have to be added to as a result.

A project of this sort, whose aim is to develop a small local industry and train qualified workers, falls within the scope of the UNIDO assistance programme for setting up small industries, and could be completed by means of a training programme.

A detailed study will have to be carried out beforehand in order to determine the feasibility of the operation, the production capacity of the assembly unit and the equipment required, together with the type and range of implements to be produced.

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APPENDICES

Appendix 1

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livestock embarked at Berbera

. Survey of prices for livestock, meat, hides and skins

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tanning hides.

9. MAPS AND PHOTOGRAPHS

Maps

Three types of map were used:

. 1:125 000 hydrological maps drawn up in 1954,

. 1:125 000 geological maps drawn up in 1969,

. 1:100 000 topographical maps drawn up in 1976.

Photographs

Photo-interpretation was carried out with the aid of the following photographic coverage:

. Mission 683A, Conorada region, ex-British Somaliland. Scale 1:20 000. 1952-1954.

. Landsat imagery. Scale 1: 500 000. The satellite photographs used were Nos 178 052 (24/8/78), 178 053 (17/6/79) and 177 053 (27/12/78) (black and white points - Channel 7; coulour slides - Channels 4.5 and 7).

Appendix 2

LIST OF COMMON PLANTS IN THE NORTH WEST REGION

Scientific name (Genus ans species)	Family	Vernacular name (Somali)
A. bussei Harms ex Sjöstedt	Mimosaceae	Galool
A. edgeworthii T. Anders	Mimosaceae	Jeerin
A. etbaica Schweinf.	Mimosaceae	Sog-Sog
A. horrida (L.)Willd. subsp. benadirensis (Chiov.) Hillcoat & Brenan	Mimosaceae	Sarmaan
A. mellifera (Vahl) Benth. subsp. mellifera	Mimosaceae	Bileil
A. nilotica (L.) Del. subsp. leiocarpa Brenan	Mimosaceae	-
A. senegal (L.) Willd.	Mimosaceae	Cadaad
A.tortilis (Forsk.)Hayne subsp. spirocarpa (Hochst.ex A.Rich) Brenan	Mimosaceae	Qurac
Acalypha fruticosa		Dikri
Acokanthera schimperi (DC.)Oliv.var. ouabaio(Schweinf.exLewin) Cuf.	Apocynaceae	Wabai
Adenia aculeata (Oliv.) Engl.	Passifloraceae	
Adenium obesum		Adaahi
Aeluropus lagopoides (L.) Chiov.	Gramineae	
Aerva persica (Burm. f) Merr.	Amaranthaceae	Wan ad
Aloe breviscapa Reynolds & Bally	Liliaceae	Dacar
A. megalacantha Bak.	Liliaceae	Dacar
Andropogon kelleri Hack.	Gramineae	Duur
Aristida adscensionis L.	Gramineae	Tinleh
A. kelleri Hack.	Gramineae	Baal-Xoore
Avicennia marina (Forsk.) Vierh	Verbenaceae	-
Balanites glabra Mildbr. & Schlecht.	Simaroubaceae	
B. orbicularis Sprague	Simaroubaceae	
Blepharis edulis	Acanthaceae	Caraan car
Boscia minimifolia Chiov.	Capparidaceae	Meygaag
Buxus hildebrandtii Baill.	Buxaceae	Dhosoq
Cadaba farinosa Forsk. subsp. farinosa	Capparidaceae	Dhiitacab
C. glandulosa Forsk.	Capparidaceae	Dukhaan
Cadia purpurea (Pice.) Ait.	Papilionaceae	Salalma
Calotropis procera (Ait.) Ait. f.	Asclepiadaceae	Booc
Capparis cartilaginea Decne	Capparidaceae	
Caralluma sp.	Asclepiadaceae	Gavracato
Cassia italica (Mill.) Lam. ex F.W. Andr. subsp. micrantha Brenan	Caesalpiniaceae	Jaleelo
Cenchrus ciliaris L.	Gramineae	Baldhoole cagaar
Chrysopogon aucheri(Boiss.)Stapf var.quinqueplumis (A.Rich) Stapf	Gramineae	Dareemo
Cissus sp.	Ampelidaceae	Carmo
Combretum sp.	Combretaceae	Cobol
Commiphora spp.	Burseraceae	Xagar,Xagar madow
Convolvulus hystrix Vahl	Convolvulaceae	-

Scientific name (Genus and species)	Family	Vernacular name (Somali)
Crotalaria albicaulis Franch.	Papilionaceae	-
Crotalaria. sp.	Papilionaceae	Casuuro
Crotalaria laxa Benth.	Papilionaceae	Xarmal
Croton cliffordii Hutch. & E.A. Bruce	Euphorbiaceae	Baahiye
Cymbopogon schoenantus	Gramineae	Caws dameer
Cynodon dactylon (L.) Pers.	Gramineae	Doomar
Cyperus conglomeratus Rottb.	Cyperaceae	
Dactyloctenium scindicum Boiss.	Gramineae	Saddexo
Dalbergia sp.	Papilionaceae	Dhuyuc
Datura metel L.	Solanaceae	-
Delonix elata (L.) Gamble	Caesalpiniaceae	-
Dipterygium glaucum Decne	Capparidaceae	
Dobera glabra (Forsk.) Juss ex Poiret	Salvadoraceae	Garas
Dodonaea viscosa L.	Sapindaceae	Xayramad
Dracaena schizantha Bak.	Agavaceae	-
Enneapogon brachystachyus Jaub. & Spach	Gramineae	-
E. elegans (Nees) Stapf	Gramineae	
Enteropogon somaliensis Chiov.	Gramineae	Caws cad
Eragrostis sp.	Gramineae	Xarfo
Eremopogon foveolatus (Del.) Stapf	Gramineae	-
Euphorbia cuneata Vahl	Euphorbiaceae	Dirin dhir
E. grandis Lem.	Euphorbiaceae	Xasaadin
Farsetia sp.	Cruciferae	-
Gnidia somalensis (Franch.) Gilg	Thymelaeaceae	-
Grewia erythraea Schweinf.	Tiliaceae	Medanyu
G. schweinfurthii Burret	Tiliaceae	Medanyu
G. tenax (Forsk.) Fiori	Tiliaceae	Dhafanur
G. villosa Willd.	Tiliaceae	-
Heliotropium sp.	Boraginaceae	Xaabo cad
Heteropogon contortus (L.) Roem. & Schul.	Gramineae	Bur Guduud
Hildebrandtia africana Vatke	Convolvulaceae	-
Hibiscus somalensis	Malvaceae	Mira-Geel-Jire
Hypoestes hildebrandtii Lindau	Acanthaceae	Faarayood
Indigofera articulata Gouan	Papilionaceae	-
I. ruspolii Bak. f.	Papilionaceae	Jilab
Iphona rotundifolia Oliv. & Hiern	Compositae	Gagabood
Ipomoea cicatricosa Bak.	Convolvulaceae	Waxara-Waalis
Jatropha dichtar Macbr.	Euphorbiaceae	
J. parvifolia Chiov.	Euphorbiaceae	
J. robecchii Pax	Euphorbiaceae	
J. spinosa (Forsk.) Vahl var. somalensis Pax	Euphorbiaceae	Jilba dhiig
J. villosa (Forsk.) Muell.-Arg. var villosa	Euphorbiaceae	
Juniperus procera Endl.	Cupressaceae	Dayib
Justicia minutifolia Chiov.	Acanthaceae	Buuxiso

Scientific name (Genus ans species)	Family	Vernacular name (Somali)
Kelleronia quadricornuta Chiov.	Zygophyllaceae	
Kirkia sp. cf. tenuifolia Engl.	Simaroubaceae	
Kleinia sp.	Compositae	
Lasiocorys argyrophylla Vatke	Labiatae	
Lasiurus hirsutus (Forsk.) Boiss.	Gramineae	Darif
Latipes senegalensis Kunth	Gramineae	
Leptadenia pyrotechnica (Forsk.) Decne.	Asclepiadaceae	Moroh
Leucas cuneifolia Bak.	Labiatae	
L. jamesii Bak.	Labiatae	
Limonium axillare (Forsk.) O. Kuntze	Plumbaginaceae	
Lithospermum hispidissimum Sieb. ex Lehm.	Boraginaceae	
Loewia glutinosa Urban	Turneraceae	
Lycium europaeum L.	Solanaceae	Surad
Maerua crassifolia Forsk.	Capparidaceae	
Odyssea mucronata Stapf	Gramineae	-
Olea africana Miller	Oleaceae	Weger
Panicum turgidum Forsk.	Graminae	Dungaare
Parkinsonia aculeata L.	Caesalpiniaceae	-
Paspalidium desertorum (A.Rich) Stapf	Gramineae	
Pennisetum dichotomum (Gmel.) Henr.	Gramineae	
P. villosum R. Br.	Gramineae	
Phoenix reclinata Jacq.	Palmae	
Pterodiscus ruspolii Engl.	Pedaliaceae	
Pulicaria attenuata Hutch. & B. L. Burtt	Compositae	
Rhigozum somalense Hall. f.	Bignoniaceae	Biniin
Salsola forskalii Schweinf.	Chenopodiaceae	Gulaan
Salvadora persica L.	Salvadoraceae	Caday
Sansevieria ehrenbergii Schweinf. ex Bak.	Agavaceae	Xasbul
Sarcostemma viminale	Asclepiadaceae	Xangeeyo
Sesuvium sesuvioides (Fenzl) Verdcourt	Aizoaceae	
Sideroxylon buxifolium Hutch.	Sapotaceae	
Sansevieria sp.	Agavaceae	Xig
Solanum incanum	Solanaceae	Mooh
S. somalense Franch. var. parvifrons Bitter	Solanaceae	Xumboh
Sporobolus helvolus (Trin.) Dur & Schinz	Gramineae	
S. marginatus Hochst. ex A.Rich	Gramineae	Dixi
S. ruspolianus Chiov.	Gramineae	Sifaar
S. spicatus (Vahl) Kunth	Gramineae	Ramaas
Suaeda monoica Forsk.	Chenopodiaceae	Xudhuun

Scientific name (Genus and species)	Family	Vernacular name (Somali)
Tamarix nilotica (Ehrenb.) Bunge	Tamaricaceae	Dhuur
Tephrosia sp.	Papilionaceae	
Themeda triandra Forsk.	Gramineae	Daba shabeel
Tragus racemosus (L). All.	Gramineae	Xarfo
Tribulus terrestris L.	Zygophyllaceae	-
Vernonia cinerascens Schultz Bip.	Compositae	
Withania somnifera (L.) Dunal	Solanaceae	
Zygophyllum coccineum L.	Zygophyllaceae	
Z. hildebrandtii Engl.	Zygophyllaceae	Mawo
Zizyphus hamur Engl.	Rhamnaceae	Xamudh
Zizyphus mauritiana	Rhamnaceae	Gob

Appendix 3

GRASSES FOR RESEEDING DENUDED LAND IN EAST AFRICA
(Source : Pratt & Gwynne 1977)

Species and type		Site requirements						Nature of seeds and sowing rates	
A A = annual P = perennial C = creeping T = tufted		Minimum rainfall (mm/yr) in areas of bimodal distribution (for single season rainfall, add 100 mm)	Preferred soil type ⊕ most suitable + also suitable					Nbr of pure seeds ('000/kg) F = fluffy f = slightly fluffy	Sowing rates in kg/ha to plant 100 seeds per m2
			loose sands	loams	alluvial silts	black clays	volcanic ash		
Cenchrus ciliaris	TP	450	⊕	+	⊕		+	F 350–400	2.5 - 3
C. pennisetiformis	A	200	⊕	⊕	⊕			F 350–400	2.5 - 3
C. setigerus	TP	450	+	+	⊕	⊕	+	350	3
Chloris roxburghiana	TP	500-	⊕	⊕	+			6 000–13 000	0.1 - 0.2
C. virgata	A	450	⊕	+	+	+		f 2 000	0.5
Chrysopogon aucheri (C. plumulosus)	TP	350	⊕	+	+		+	F 450–550	2
Cynodon dactylon (C. nlemfuensis)	CP	650	⊕	+	⊕			2 200	0.5
Dactyloctenium sp.	CP	400	+	+	+		+	2 400	0.5*
Enteropogon macrostachyus	TP	600	⊕	⊕				180	5.5
E. rupestris	TP	350		+	⊕	+		600	1.7
Eragrostis cilianensis	A	200	+	+	+	+	+	11 000	0.1
E. sp. near curvula	TP	600	+	+	+			5 700	0.2
E. superba	TP	550	⊕	⊕	+			100	10
Eriochloa nubica	A	250		+	⊕	+	+	1 100	1
Eustachys paspaloides	P	550	+	+		+		6 000–9 000	0.2
Latipes senegalensis (Leptothrium senegalense)	A	350	+	+				350	3
Leptochloa obtusiflora	TP	600		+	+			3 300	0.3 - 0.4
Panicum coloratum complex	P	varies	+	+	+	+		900–1 100	1
P. maximum	TP	600	⊕	⊕	+			700–950	1.3
Paspalidium desertorum	P	400		+	+			1 200	1
Sporobolus ioclados (S. marginatus)	TP	300	+	⊕	⊕	+		7 700	0.2
Tetrapogon villosus	P	350	⊕	+	+			F 380	2.7

* Applies to loose caryopses ; alternatively whole spikelets may be sown, containing one million seeds/kg and requiring 1 kg/ha to plant 100 seeds/m2.

Appendix 4

ANALYSIS OF SOME COMMON WOODY SPECIES IN THE NORTH WEST REGION

LEGEND OF THE TABLE

DM	Dry Matter
TNS	Total Nitrogenous Substances
Cell	Cellulose
TMS	Total Mineral Substances
L.S.	Lipoid Substances
Ca	Calcium
P	Phosphorus
K	Potassium
Mg	Magnesium
DNS	Digestible Nitrogenous Substances
F.U.	Fodder Unit
N.F.E.	Nitrogen free extract

All results are expressed as a % of the dry matter.

		D.M.	T.N.S.	Cell.	L.S.	TMS.	Ca	P	Mg	K	DNS	N.F.E.
Acacia nilotica	Fresh leaves	37,8	16,7	10,8	7,8	7,1	1,02	0,18	0,21	1,34	12,2	57,6
	Dry leaves	91,1	11,2	12,4	7,8	6,2	1,29	0,12	0,16	0,77	6,7	62,4
	Fresh pods	40,4	11,2	13,9	1,7	4,4	0,54	0,17	0,14	1,25	6,7	68,8
	Dry pods	90,6	9,8	18,4	2,5	4,5	0,52	0,60	0,16	1,25	5,3	64,8
Balanites aegyptica	Fresh leaves	44,2	12,9	13,9	4,8	15,7	3,71	0,10	0,68	2,01	8,4	52,7
	Dry leaves	95,0	11,5	17,9	6,7	15,5	2,91	0,06	0,73	2,42	7,0	48,4
Boscia senegalensis	Fresh leaves	51,5	17,1	21,1	2,3	12,3	1,14	0,07	1,05	0,43	12,6	47,2
	Dry leaves	90,8	24,1	21,9	2,0	9,6	0,91	0,08	0,71	0,99	19,6	42,4
Cadaba farinosa	Fresh leaves	40,3	22,5	8,0	7,6	19,7	1,97	0,14	0,69	5,80	18,0	42,2
Cadaba glandulosa	Fresh leaves	47,8	17,3	18,2	2,3	26,4	2,06	0,12	1,00	3,08	12,8	35,8
Cassia sieberiana	Fresh leaves + flowers	32,9	15,9	21,4	2,5	6,1	0,37	0,22	0,21	1,36	11,4	54,1
Commiphora africana	Young leaves	91,7	14,2	12,9	2,5	9,4	0,98	0,18	0,48	2,47	9,7	61,0
	Fruits	85,8	8,4	21,3	4,5	7,0	0,88	0,16	0,39	1,45	3,9	58,8
Grewia bicolor	Fresh leaves	40,3	15,4	21,8	3,5	9,0	1,09	0,19	0,44	1,46	10,9	50,3
	Dry leaves	89,9	5,8	17,5	7,4	13,5	3,02	0,14	0,57	1,22	1,3	55,8
Leptadenia pyrotechnica	Fresh leaves	21,0	13,9	14,7	5,2	15,6	2,25	0,20	-	-	9,4	50,6
	Young shoots	31,6	8,6	42,3	3,2	7,2	0,80	0,11	0,23	1,62	4,1	38,7
Maerua crassifolia	Fresh leaves	44,0	22,5	8,4	6,3	18,9	2,61	0,12	0,92	2,80	18,0	43,9
Prosopis africana	Dry pods	91,4	8,6	19,9	2,9	3,4	0,23	0,10	-	-	4,1	65,2
Salvadora persica	Fresh leaves	29,2	11,7	12,0	2,3	31,4	6,83	0,09	0,81	1,71	7,2	42,6
	Leaves + young shoots	27,4	16,3	14,8	1,4	30,2	6,01	0,12	-	-	11,8	37,3
Tamarix nilotica	Young shoots	39,1	8,1	20,1	2,2	22,6	3,04	0,07	1,68	0,82	3,6	47,0
Ziziphus mauritiana	Fresh leaves	39,4	14,2	14,1	3,0	9,4	2,28	0,16	0,28	0,85	9,7	59,3
	Dry leaves	95,1	8,5	14,6	8,1	10,9	2,25	0,12	0,28	1,08	4,0	57,9

Appendix 5

ANALYSIS OF SOME COMMON GRASSES IN THE NORTH WEST REGION AND IN OGADEN

Table I

MINERAL MACRO-ELEMENT CONTENT

Species	D.M. as % of U.M.	Mineral elements as % of dry matter							Ratio		
		Total min. substances	Silica	Ca	P	Mg	K	Na	Ca/P	Ca/Mg	K/Na
Paspalidium germinatum	21.15	10.71	5.09	0.37	0.193	0.14	2.51	0.529	1.9	2.6	4.7
Dichanthium annulatum	36.55	8.87	4.86	0.19	0.151	0.11	1.54	0.019	1.3	1.7	81.1
Chrysopogon aucheri	42.50	9.41	5.14	0.52	0.109	0.16	1.24	0.029	4.8	3.3	42.8
Aristida adscensionis	35.75	9.78	6.44	0.26	0.155	0.15	1.14	0.008	1.7	1.7	142.5
Lactyloctenium scindicum	24.50	9.89	3.02	0.63	0.144	0.20	1.52	0.797	4.4	3.2	1.9
Chloris virgata	30.35	14.47	4.75	0.89	0.364	0.30	3.06	0.037	2.4	3.0	82.7
Tetrapogon cenchriformis	91.20	7.43	2.19	0.49	0.140	0.17	1.91	0.021	3.5	2.9	91.0

Table II

MINERAL TRACE - ELEMENT

(content in ppm)

Species	D.M. as % of U.M.	Co	Cu	Zn	Mn	Fe
Paspalidium germinatum	21.15	0.07	5.5	36.3	34	170
Dichanthium annulatum	36.55	0.05	4.6	48.7	46	113
Chrysopogon aucheri	42.50	0.11	4.6	31.8	68	177
Aristida adscensionis	35.75	0.22	7.2	33.1	55	240
Dactyloctenium scindicum	24.50	0.16	6.1	26.8	48	400
Chloris virgata	30.35	0.28	6.2	42.6	45	462
Tetrapogon cenchriformis	91.20	0.12	4.9	29.3	36	85

Table III

FODDER VALUE

Composition as % of dry matter (D.M.)

Species		D.M. as % of U.M.	Composition as % of dry matter (D.M.)					Fodder value			
			T.N.S.	Cellulose	Lipoid substances	N.F.E.	Total min. substances	Of D.M.		Of U.M.	
								F.U.	g D.C.P.	F.U.	g D.C.P.
Paspalidium germinatum	(flowering)	21.15	9.83	37.00	2.00	40.46	10.71	0.45	56	0.09	12
Dichanthium annulatum	(flowering)	36.55	5.32	36.20	1.46	48.15	8.87	0.51	14	0.19	5
Chrysopogon aucheri	(flowering)	42.50	6.24	38.45	1.65	44.25	9.41	0.42	23	0.18	10
Aristida adscendionis	(flowering)	35.75	10.58	33.45	1.84	44.35	9.78	0.58	63	0.21	23
Dactyloctenium scindicum	(flowering)	24.50	12.21	34.10	1.56	42.24	9.39	0.56	78	0.14	19
Chloris virgata	(flowering)	30.35	9.27	29.10	2.55	44.61	14.47	0.62	50	0.20	15
Cynodon nlemfuënsis	(flowering period)	31.00	15.81	29.65	2.52	38.76	13.26	0.63	112	0.20	35
	(27-day-old shoots)	33.80	11.44	30.40	2.21	43.75	12.20	0.62	71	0.21	24
Tetrapogon cenchriformis	(straw)	91.20	6.55	34.35	1.54	50.13	7.43	0.60	26	0.54	24

Appendix 6

ILLUSTRATIONS

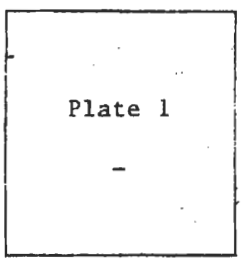
Plate 1

DESCRIPTION OF PHOTOGRAPHS

Photo 1 : Buxus hildebrandtii, Dodonea viscosa and Mimusops kummel. In the foreground, the very unusual Adenia veneata with Buxus hildebandtii.

Photo 2 : Buxus hildebrandtii open scrub, near Gacan Libaax. In the left foreground, Mimusops kummel.

Photo 3 : Juniperus procera relic forest at Gacan Libaax. In the foreground, Dodonea viscosa.

Photo 4 : General view of Acacia etbaica open scrub between Boorama and Ruqi.

Photo 5 : Opuntia facies in the Acacia etbaica zone, near Bown. The cactus grows in the form of large, thick clumps.

Photo 6 : Typical view of Acacia etbaica open woodland on the plateau between Gadhyogol and Faraweyne.

Photo 7 : Acacia etbaica - Euphorbia grandis transition scrub near Boocda Kabaad.

Photo 8 : In the foreground, Acacia edgeworthii - Acacia spirocarpa - Commiphora community between Dacarbudhug and the Togga Waheen. In the background, basalt plateaus.

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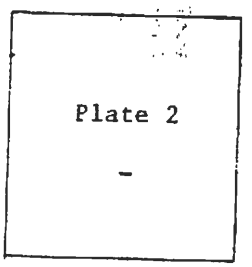
Plate 2

DESCRIPTION OF PHOTOGRAPHS

Photo 1 : Rhigozum somalense open scrub, near Qabri Baxar.

Photo 2 : Iphionia rotundifolia open grassland near Waraqadhigta. The scattered and lopped trees are Balanites orbicularis.

Photo 3 : Panicum turgidum - Balanites orbicularis open woodland near Bullaxaar.

Photo 4 : Gazelle in Panicum turgidum open woodland between Jidhi and Ceel Gaal. The bush is Balanites.

Photo 5 : Destruction of the forest on the plateau (here Acacia tortilis) in order to provide food for animals and firewood for the nomads.

Photo 6 : Overgrazed facies in Acacia bussei open woodland near Horahaadley. The increaser is Aloe sp.

Photo 7 : General view of the subcoastal zone, from Gacan Libaax. The arrow indicates Lafaruug.

Photo 8 : Nomad camp in the Acacia bussei xeric zone.

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DESCRIPTION OF PHOTOGRAPHS

Photo 1 : Herd coming from the Ethiopian frontier (Faraweyne) and heading for Hargeysa to be sold and then slaughtered and/or exported.

Photo 2 : Consequences of the drought in the Wajale plain. In 1980, 60 % of the livestock died.

Photo 3 : General view of the togga Waheen, to which herds come to drink.

Photo 4 : Nomad woman travelling with her camel, which carries the framework of the family hut.

Photo 5 : The subcoastal zone between Cabdi Gaadir and Jidhi. The trees in the middle of the togga are Tamarix nilotica.

Photo 6 : Traditional method of watering the animal near the togga Farsaxidh.

Photo 7 : Gorges of the togga Waheen.

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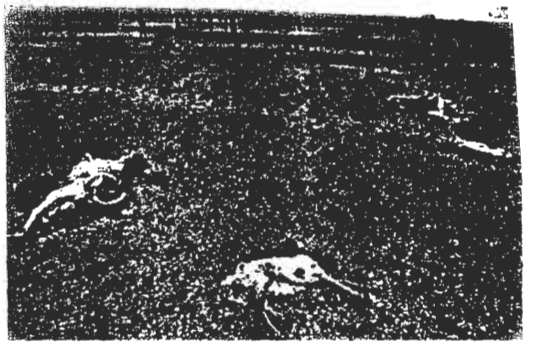

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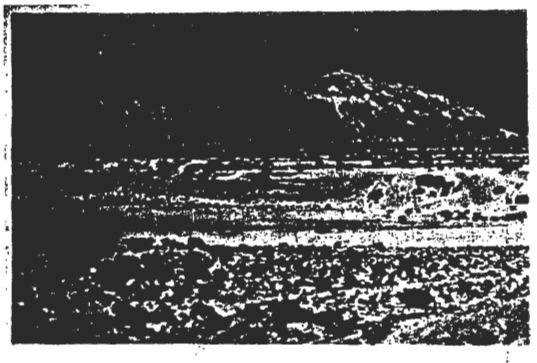

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