SURVEY OF NORTHERN RANGELANDS
SOMALI DEMOCRATIC REPUBLIC

REPORT ON IMPROVEMENT OF THE RANGELANDS AND RELATED PROBLEMS IN NORTHERN SOMALIA

by

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1 Purposes of the Consultancy

The consultant visited Somalia to advise the SOM. 12 project and the Somalian Government on range improvement and related problems in the Northern Territory.

2 Timing and Schedules

The consultant arrived in Mogadishu 18 January at noon, and after having met official authorities proceeded the following day to Hargeisa, together with SOM. 12 Project Manager.

19-20 January	Discussions in Hargeisa with the Project Manager, Mr. B. Barkley and the Deputy Co-Manager, Range Specialist, Mr. Ahmed Haji Noor. Field visits around Hargeisa.
21 January	Visit to south-western zone of Hargeisa: Sheikh Isahak and Ban Tuyo with the deputy Co-Manager.
22-24 January	Visits to Zeila, Borama, Amoud, Kalabeit, Tug Wajaleh and Aburein with Mr. Haji Noor.
25-29 January	Visits to Burao, Bohotleh, Ainabo, Garadag, El Afwein, Erigavo, Mait, Berbera, Go'o, Gaanlibah with Mr. Ahmed Haji Noor.
30 January - 2 February	Visits around Hargeisa. Report.
3-6 February	Contacts and discussions in Mogadishu with Government authorities, UNDP and FAO Representatives and SOM. 12 Review Mission.

The itinerary shows that the consultant travelled some 3 500 km and visited the major grazing zones of the project area, identifying the problems involved and assessing possible solutions.

3 Official Contacts

Upon arrival in Mogadishu, the consultant met:

- Mr. Mohamed Musa Awaleh, acting Director-General in the Ministry of Livestock, Forestry and Range, Head of the Range Service and Co-Manager of the SOM. 12 Project.

- Mr. Mohamed Jama Omer, Acting Director of the Forestry Department, Ministry of Livestock, Forestry and Range, Head of the Forest Service.

- [illegible]eloff, FAO Senior Agricultural Adviser to Somalia.

In the Northern Territory the consultant met:

- The Governor of the N.E. Region at Bur'ao.

- The Deputy Governor of the N.W. Region at Hargeisa.

- The Development and District Affairs Officers in Zeila, Borama, Bohotleh, Erigavo and Berbera.

He had also technical discussions with the SOM. 12 counterpart staff of range officers and assistants.

4 Present Situation of Stock-Raising Industry and of the Rangeland in the Northern Region

4.1 It is commonly known that the stock-raising industry is by far the major economic resource of Somalia in general and the Northern Territory in particular.

The present annual exports of livestock from Berbera are approximately 1 100 000 sheep and goats, 20 000 camels and 40 000 cattle (Hartley V.C.) which represents a FOB cash value of approximately $26 million ($15 per head/sheep and goats, $140 per head/camel and $100 per head/cattle). This value represents approximately twice the price paid to the stock raiser in the bush.

The various taxes from these exports amount to about $3.25 million (25 percent of the price paid to the stock raiser).

The total number of animals raised is not known, neither is the meat production, nor the number of animals consumed by the stock raisers themselves. However, all observers agree on a sharp increase of livestock numbers during the past ten years as a result of:

- Improvement of health conditions.
- Sharp increase in number of watering points.
- An important and increased demand on foreign markets (Persian Gulf, Saudi Arabia and Yemen).

In spite of the poor range conditions, all animals observed (in the middle of the dry season) during field visits were in fairly good shape as a result of a good rainy season in 1971.

4.2 The ranges

It is obvious, and all experts (either national or foreign) agree on the fact that the northern rangelands are in a poor shape and the depletion trend goes downward rather quickly.

Without referring back to the beginning of this century when grass formations covered huge areas feeding herds of rhinoceros, elephants, oryx and other big game, both experienced officers like Mr. Haji Ahmed Mohamoud and younger men like Mr. Ahmed Haji Noor well remember much better range conditions only ten years ago.

The decline in range conditions is due to several causes, among them:

- Important increase in livestock numbers as a result of population growth and demand on foreign markets.
- Sharp increase in watering points and mostly cisterns allowing the livestock to remain all year round in the same areas. This has broken the centuries old equilibrium between man-livestock and natural ecosystems. This balance was a result, inter alia of transhumance from Haud to plateau and coastal Plain.
- No range management system has been implemented to replace the former transhumance habits (and this is unfortunately true in many arid and semi-arid developing countries).

- No fodder crops are grown.

- A significant improvement in animal health conditions have been achieved and epizootics have been curbed which also greatly contributes to the increased livestock numbers.

- Agricultural settlement and extension of town and villages surrounded by several km wide circles of ruined rangelands (permanent overgrazing).

If this situation were to continue, the livestock would have to depend more and more on seasonal rains as the proportion of perennial fodder species decreases with overgrazing and overbrowsing. The result would be catastrophic losses when two or more consecutive drought years occur. Correlatively the proportions between the different kinds of livestock would change toward a higher proportion of camels and goats and a decrease in proportions of sheep and cattle as has been observed in other similar countries.

Though the ranges and livestock industry of the northern territory have reached a crucial stage, the situation is, however, far from desperate. Many encouraging facts are recognised:

- The Government, the local authorities (and sometimes the stock owners) are aware of the importance of the problem and willing to solve it.

- A Range and Livestock Seminar was held in Burao in December 1971 between the Administration and the stock raisers with the help of SOM. 12 project. The recommendations of this seminar are considered as excellent.

- The Administration prepared a law for establishing a Range Development Fund, fed from taxes on livestock exportation and marketing1/ which is awaiting Government approval.

- A national Range Council will be established to formulate policy and make decisions concerning range resources.

- 18 Range and Livestock Improvement Associations have been established among stock owners.

- About 24 000 km^2 of range reserves (deferred grazing) are being delimited and will be implemented during the next rainy season, within the framework of the Range and Livestock Improvement Associations.

- A country-wide Range Service will be set up in the near future.

- Experience shows that in many parts the ranges are still able to recover after protection during a good rainy season. And this is being recognised by some stock owners (in Bohotleh area, for instance).

- Ten exclosures of 1 ha each are being fenced which will permit measurement of the production and potentials of the main range types and their ability to improve. In the author's opinion, the sites of these exclosures have been very well selected, even if some of them could have been located closer to main roads to facilitate accessibility, control and allow more demonstrative value to people travelling across the country.

All these facts and others must be credited both to the action of the Government and the SOM. 12 project. Nevertheless, there is still much to do to improve the ranges and the livestock feeding conditions.

1/ A return of 5% of the cash value of the animal products exported would seem a fairly reasonable order of magnitude of the input in range development ($300 000 yearly), since the various taxes in the marketing processes amount to about 25%. This means a reinvestment of 1/4 of these taxes in range resources.

The time now is for field action. As the writer sees it, the strategy should be [illegible] several simultaneous targets:

- Short-term.
- Intermediate.
- Long-term.

5 Suggestions and Recommendations

Short-Term Actions:

- Establishing a training and demonstration centre for fodder crops and range improvement techniques and local demonstration plots in the main ecological areas.
- Continue extension work with range and livestock improvement associations and range reserves. Establishing new range and livestock improvement associations and range reserves aiming at a full-scale deferred grazing system covering progressively all the region (intermediate and long-term).

Intermediate-Term Targets

- Setting up an effective range service to implement the development strategy and advise the range and livestock associations. The necessary personnel would be trained in the training and demonstration centre referred to above.

Long-Term Targets

- Collect all necessary information on livestock numbers, range production and potentials in order to determine the stocking rates and set up a sound range policy and development planning based on range ecology maps in each ecological zone. It will be necessary to control livestock numbers which does not necessarily imply decrease in production, on the contrary. In effect the number of lambs raised per hundred ewes is barely 50; 80 percent should be a reasonable target with fairly good feeding conditions.

5.1 Short-term targets

5.1.1 Fodder crops development

As H.B. Gilliland pointed out in the recommendations of his report of 1945 "The crux of the whole question of the progress of the Somali lies in the adequate provision of food for his stock in time of drought. No matter how vigorously water supplies may be improved, unless the feeding of livestock during this time is planned for, little permanent relief is likely." This need is recognised and a market for forage exists already. Hay of native grasses often collected too late in the season inside privately owned reserves is marketed in Berbera at a price of Som Shillings 750 to 1 200 for a two-ton lorry load. Say an average of 1 000 Shgs. i.e., approximately $75 per metric ton. Assuming a minimum daily maintenance requirement of 2 kg of this poor hay per sheep, the daily feeding cost is about $0.15 per sheep, which is enormous and uneconomic.1/ The potential for growing fodder crops is important, mainly in the north-western area of Aburein, Kalabeit, and Borama which benefit from good rainfall - 400 to 600 mm (16-24 inches), and where good deep alluvial medium textured soil exists over more than 150 000 hectares. In the writer's rough estimation, there is a potential

1/ A camel-load of sorghum straw (150 kg) is marketed in Hargeisa at a price of 30 Som. Shillings; i.e. $0.030 per kg.

of about 20 000 ha north of Hargeise. This area is also the main cattle production and farming zone. These are the reasons why a training and demonstration centre should be set up in this region (possibly Kalabeit).

Demonstration plots should also be set up in other areas (Burao, Bohotleh, Erigavo, Zeila, Berbera, Las-Anod) to explore the feasibility and economic value of growing drought-resistant fodder crops under certain conditions (watershed management) in these less favourable areas.

In the above-mentioned north-western area the main fodder crops to be grown are:

- Cenchrus ciliaris - Buffle grass
- Dolichos lablab
- Dolichos biflorus
- Cowpeas
- Cactuses
- Atriplex
- Thornless fodder acacias and other legume fodder trees

5.1.2 Cactuses

5.1.2.1 General

The advantage of growing fodder cactuses is not generally recognised; the farmers and stock owners are not yet prepared to grow this fodder crop. But this does not mean that nothing should be done now about it. The duty of the project is to set up demonstration plots and nurseries in order to convince the people. In fact, speaking about cactuses in general has no meaning since there are about 300 species in the genus Opuntia only growing from 50° Lat. North to 50° Lat. South. Many species have no feeding interest and/or are not ecologically adapted to northern Somalian conditions. Some are dangerous weeds in the rangelands, but a few of them are extremely productive fodder crops perfectly accepted by all ruminants.

Let us give a few examples from developed or developing countries throughout the world.

In the South-Eastern USA (Texas) spineless fodder cactus (Opuntia ellisiana) has been grown as fodder for at least 70 years (Griffiths, Hare and others).

In north-eastern Brazil (Sertao region), where the ecological conditions are close to those of north-western Somalia with similar vegetation; the cattle industry is to a large extent based upon 300 000 ha of cultivated fodder cactus and the yields recorded per hectare may reach 100 to 200 tons of green fodder yearly (Correa de Souza, Bonnemaison and others). The species and varieties cultivated in north-eastern Brazil are:

- Opuntia ficus indica var. inermis, locally named "palma gigante."
- Opuntia inermis - "palma redonda"
- Nopalea cochenillifera - "palma miuda".

The cattle are reported to ingest up to 60 kg of these cactuses daily during the dry season.

In South Africa, in the Karoo region, the merino sheep industry is partly based on fodder cactus, Atriplex and small shrubs [illegible] during the dry season (De Kock, Bonsma, Hare and others).

Research and selection have been carried out to obtain improved varieties. The species and varieties cultivated in this region are:

- Opuntia robusta cultivar - "chico"
- Opuntia robusta cultivar - "monterrey"
- Opuntia robusta cultivar - "robusta"
- Opuntia fusicaulis

In North Africa fodder cactuses (O. ficus indica var. inermis, mainly) are being cultivated in the arid and semi-arid zones. Tunisia, for instance, has about 100 000 ha of cactuses and 10 000 ha are now being planted yearly in the arid zone with the assistance of a World Food Programme project (Project 482) and an FAO project (Tun 25).

In Sicily, cactuses are grown both as fruit and fodder crops over some 100 000 ha.

This shows that growing fodder cactuses is considered in many arid and semi-arid countries as one of the major tools to meet the feeding needs of the livestock during the dry season. Thus, there is no reason to believe that this solution, which has worked out successfully elsewhere, would not be effective in Northern Somalia. On the contrary, there is evidence that the ecological conditions allow the thriving of several cactus fodder species. Spineless Opuntia ficus indica thrive (up to 4-6 m high) in many places in Hargeisa without irrigation. The same is true in Amoud, the upper and lower Sheikh, in Erigavo and elsewhere. Nopalea cochenillifera thrives in Hargeisa in the hedges bounding the club house garden.

Other cactuses might be introduced and tried, for instance:

- Opuntia undulata (absolutely void of thorns and glochids)
- Opuntia inermis ("Burbank's cactus")
- Opuntia fusicaulis (spineless)
- Opuntia megacantha, spineless variety

Some other species and varieties have been observed in the northern region:

- Opuntia bergeriana: sub-spineless type region of Borama
- Opuntia bergeriana, spiny type: Hargeisa
- Opuntia ficus indica var. amyclaea: Hargeisa, Kalabeit, Bohotleh and other localities.

The first named type in the last group is invading ranges in the Borama area (North and West). It was introduced across the border from Ethiopia and propagated by Baboon which eat the fruits. This type is heavily browsed by camels and goats during the dry season. Feeding trials with cattle have proved successful after singeing to remove the numberous glochids (small hook-shaped spines). The propagation of this variety is not advised, it has a rather low production potential and cannot be considered as a fodder crop (too difficult to manipulate and more or less reluctantly accepted by animals).

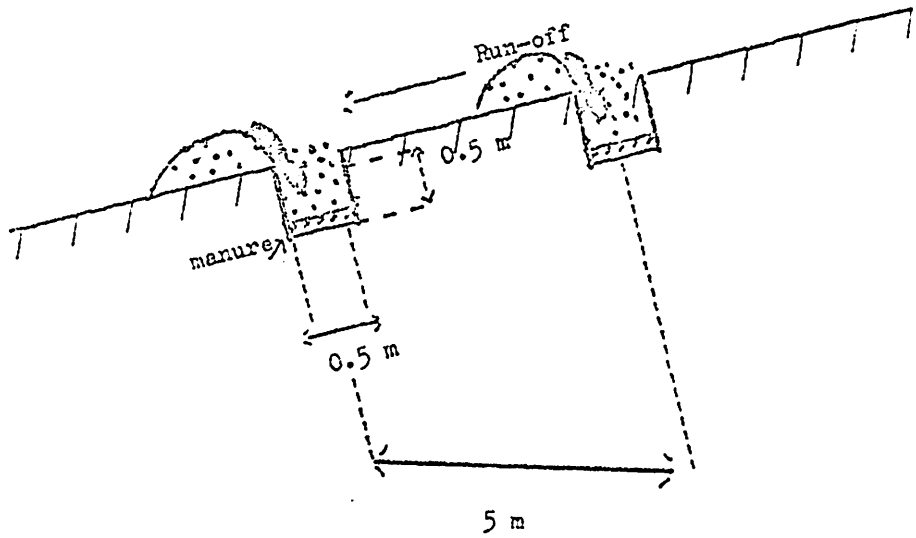
The second type, which has long yellow spines, is a noxious weed which may invade the ranges and must be kept under severe control, or, better, totally eliminated.

The third above-named may be used as a fence in the fodder cactus plantation (three parallel lines 1 m apart) but cannot be considered as a useful fodder crop; the fruits are edible to humans. The writer does not claim that fodder cactuses are miracle plants that will solve all the feeding problems in Somalia. But they can certainly bring about a significant contribution to it, provided that minimum technical specifications are closely carried out. Some problems may arise in developing this crop, hence it should be developed with prudence in demonstration plots, and the planting, production and cropping techniques may require local adaptation.

5.1.2.2 Cactus production and animal feeding techniques

The fodder cactuses should be planted after the beginning of the rainy season when the range species start growing. If planted during the dry season, severe damage could occur from ground squirrels or other rodents or wild life, since this cactus is one of the rare green fodders available at that time.

The plantation must be carefully fenced and no animal admitted. When cut, the joints or pads (cladods) must be left to wilt for one week or so, otherwise if planted fleshy and turgescent they may rot. The soil must be deep and run-in is desirable, but areas flooded periodically for several days must be avoided. The plantation is usually made in rows about 5 m apart. Small trenches of 50 x 50 cm are dug in contour. About 3-4 kg of good sheep manure1/ per linear meter (6-10 tons/ha) should be placed in the bottom of the trench and then covered with 10-20 m of soil material. On top of the soil material double joints are laid 0.5 to 1 m apart and the lower joint totally covered by another layer of soil material. The remainder of the soil material from the trench should be left as a small bank on the lower side wherever the ground slopes.



Manuring is essential to obtain a rapid growth and good yields as the plant is a heavy nitrogen feeder. The ground between the cactus rows should be ploughed 2-4 times yearly to maintain a good mulch and allow the best water intake possible, weeds must be carefully eliminated.

1/ Great quantities of manure are available everywhere in the livestock pens (Zeribas or other) which are not actually used.

The first yield may be cut 3-5 years after planting, depending on the local conditions of growth (first yield when the plant reaches 1.50 m). After each cropping 20-30 t of manure per ha will be spread between the rows. The plants are cut at about 1 m above ground level. The crop is collected during the dry season every 2-3 years depending on local conditions. In order to obtain a continuous production, ½ to ⅓ of the plantation should be cut every year. There is enough plant material in Hargeisa to establish several hectares of fodder plantation nurseries.

Cropping and feeding techniques are very simple. The joints are cut with a sickle or a large knife and carried away to the feeding place (Zeriba or other). If animals were admitted the plantation would be rapidly destroyed by over-browsing. An adult animal can absorb about 10 percent of its body weight of cactus daily (but there are, of course, differences from one animal to the next within each type of livestock), provided those animals receive about one percent of their body weight ad dry roughage (straw, browse or hay). This small amount of dry roughage is necessary to prevent diarrhoea, which would result from a pure cactus diet. As the cactus contains 75 to 85 percent of water in the dry season, the water needs of the animals will considerably be reduced (a sheep eating 4 kg of cactus a day will thus absorb 3 to 3.5 kg of water which is normally enough). The above diet is sufficient for maintenance. For fattening, the roughage will be replaced by good hay or preferably by concentrate with a good protein content (acacia or other legume pods, for instance). Fodder cactuses have a chemical composition similar to fodder beet and a similar feeding value.

5.1.2.3 Atriplex (saltbushes)

The fodder Atriplex (A. nummularia, A. halimus) are, along with cactuses, one of the best fodder crops for arid zones and with use of runoff waters, they can be cultivated in areas receiving as few as 150 mm of rainfall (6 inches). They are also extremely salt tolerant; above 20 000 parts per million of salt content in the soil solutions. The root system is very deep and they can tap water from water tables as deep as 5 to 10 m and perhaps more in sandy soils.

There are very good potentials for growing Atriplex in many parts of northern Somalia including the coastal plains of Zeila and Berbera, wherever there is a water table. It is assumed that those areas cover several thousands of hectares in the coastal plains and in the gypseous area (Las-Anod to Erigavo). The production expected may be of the order of 1 000 to 2 000 feed units per ha, i.e. enough to maintain 10 to 20 sheep per ha for 3 months. As for cactus, the plantations should be fenced and no animal admitted. However, the Atriplex intake may be reduced in areas where the drinking water is very salty since the leaves of Atriplex may contain as much as 20 percent of salt on the dry matter. The combined use of Atriplex and cactus has proved to be a successful diet for sheep both in South Africa and North Africa. The sheep industry in arid Australia is to a great extent based upon ranges where salt bushes are the only feed during the dry season.

In Tunisia about 1 000 ha of salt bushes are being planted annually as fodder crops. The propagation techniques are the same as for forest trees. Seedlings are grown in polythene bags in nursery (mixture of sand, loam and manure). They are planted after 2-3 months' growth (10 cm high) after clipping and, if need be, watered when planting with 2-3 l of water or so per seedling. The seedlings are planted 1x1 or 2x2 m apart. The first crop may be cut 2-3 years after planting, depending on the rate of growth. The forage is cropped every 3-4 years at ground level and the woody parts used as firewood after the green leaves and twigs have been browsed.

5.1.4 Acacia and other legume fodder trees

Some drought-resistant acacias are good fodder producers (leaves or pods or both). Certain spineless foder mesquites are planted in Chile (Prosopis tamarugo), in Tunisia and elsewhere. The Mulga (Acacia aneura) of Australia is famous and has proved

successful elsewhere. The same applies to Acacia saligna, Acacia bivalvata from Australia, Cassia sturthii from South Africa, etc. Acacia nilotica var. indica is being propagated in the northern region, grows quickly and produces large amounts of nutritious pods.

The same applies to a native fodder tree observed in the village of Dilla (20 km from Borama in the direction of Hargeisa). This big thornless legume tree is locally known as "Gharbi" and produces numerous large pods of 2-3 x 10-15 cm and according to the villagers "a handful of those pods given daily to a cow increases the milk production significantly."

In Tunisia feeding experiments with sheep have shown a synergetic effect when fodder acacia (leaves or pods) are used together with Atriplex and cactus, i.e. each component of the diet increases the intake of the two others. Sheep can be maintained on this diet only for several months. Many local species seem worth testing as fodder trees and shrubs (feeding value, propagation methods, etc.) most of them from the capparidaceae family:

- Boscia minimifolia ("Megag")
- Maerua crassifolia ("Ditab")
- Cadaba farinosa ("Anamaie"), etc.

They are heavily browsed and might, perhaps, play an important role in supplying trace elements (B. Hartley).

5.1.4 Other fodder crops

It is obvious that several fodder crops could be cultivated in the northwestern district of Kalabeit and Borama. The main species to be tried in the first step are:

- Sudan grass
- Cenchrus ciliaris (Buffle grass)
- Dolichos biflorus
- Vigna sinensis (Cow pea)

Sudan grass should be cultivated on the best soils receiving run-in and properly manured (20-30 t per ha).

Cenchrus ciliaris is a high feeding value native plant which has been observed thriving in protected conditions (inside spiny bushes) in all the ecological zones visited. It is possible that local strains cannot be propagated successfully by seeds owing to a low germination rate as it often happens (chemical inhibitor in the glumes). But improved strains and varieties with a good germination rate are available on the market in Texas, Australia, South Africa and elsewhere.

Experiments carried out on a small scale by Mr. Hartley have shown that Dolichos biflorus is able to produce high yeilds in rainfed conditions at Hargeisa.

Many other grasses and legumes should be tried on a small scale in the [illegible] training and demonstration centre (Chrysopogon aucheri, the local Dareso, [illegible], what is its germination rate?). In the writer's opinion, the potential for [illegible] fodder crops is, at least, 5 to 10 t of hay per ha with a fairly good production [illegible].

and manuring in the above-mentioned area (at the current price of $75 a metric ton, this would be an extremely profitable operation for the farmers or Range and Livestock Improvement Associations).

5.2 Intermediate-term targets

The best results obtained in the proposed training and demonstration centre should be extended to private farmers and stock owners through extension officers and assistants, themselves trained in this centre. Local demonstration plots would show the various possibilities in the different ecological regions.

5.3 Long-term targets

- To accumulate the basic information necessary to plan and implement a sound range policy;
- To study the motivations of the graziers in order to adapt scientific knowledge and make it acceptable in the social environment and structures;
- To determine numbers of livestock in each district and grazing habits of the stock owners;
- To develop a complete check-list of the Somali plants (Somali and scientific) which is greatly needed, and later on, a flora.

[illegible] range types are not defined and their production is not known. The main [illegible] have been quickly described by Hemming (1966) and others at a [illegible] level. But this is insufficient for practical purposes. Inside [illegible] these range types are to be defined, mapped and their productivity [illegible] measured. In each of these formations according to the plant association considered, the productivity may vary as from 1 to 10 as it has been shown in similar countries. How can a reasonable plan be worked out if this is not known and mapped, the feeding value of trees, shrubs and herbs is not known either. The dynamics of plant communities are unknown. The exclosures established by SOM. 12 will help a good deal in this.

5.4 Training

The writer is not convinced of the usefulness of sending trainees abroad for long training sessions. The best way seems to be short period fellowships to acquire the necessary basic knowledge. Then an in-service training through a research, training and demonstration centre started in the beginning by qualified foreign experts in the fields of range management watershed management, fodder crops, range ecology, animal production and health, economy and marketing, pastoral sociology.

If the Government, UNDP and FAO were to work out a follow-up to the SOM. 12 project, such a training and demonstration centre should be, in the writer's opinion, the core of such a project. However, a project of this kind may raise many problems. For instance, the status of the national range officers and assistants. To attract good quality people able to work in an efficient and dynamic way in the field and the bush, it seems necessary to grant them good salaries and decent1/ daily subsistence allowance (in the writer's mind a decent daily subsistence allowance would be a 50 to 100 percent increase in salary for each day spent in the bush). If such problems are not solved, who will be willing to work in the hard conditions of the bush instead of sitting peacefully in an office?

1/ At present the daily subsistence allowances for field trips are 4,3 and 2.50 Shillings ($0.6, 0.4 and 0.3) for range officers, drivers and assistants respectively.

The present writer considers such "minor problems" vital in the long [illegible] and other problems may, perhaps, be solved through the Range Development Fund which as an autonomous body is not bound to administrative regulations.

6 Conclusions

In spite of the generally poor conditions and sharp downward trend of the northern rangelands, many favourable prospects are in view, provided that a sound management policy is defined and implemented.

The legal tools to do so are being set up and range reserves for deferred grazing are being established.

The potential for growing fodder crops to meet the scarcities resulting from the recurrent drought periods is quite good, especially in the northwestern district.

Both administrative authorities and SOM. 12 project have carried out outstanding preliminary work, although not in accordance with the Plan of Operation.

However, there is still a huge effort ahead to establish and implement a sound range and fodder crops policy based upon long-term and sustained productivity.

To reach this target, the first step should be to train personnel at all levels through an in-service training, research, demonstration and extension centre, in the various disciplines involved in range development and planning namely:

- Range Management
- Fodder crops and nutritive value of native plants
- Watershed management and erosion control
- Range ecology and mapping, plant taxonomy and physiology
- Pastoral sociology
- Animal production and health
- Economy and marketing

Such a centre could be started with a team of foreign experts and consultants to be progressively replaced by nationals. Fellowships and study tours should be granted to the best trainees. The participation of the three range officers, acting as counterpart staff in the SOM. 12 project in an international seminar and study tour to be held in Tunisia next April is strongly recommended whereby they will be able to see by themselves the results of 10 years of serious efforts in a country bearing several similarities with northern Somalia.

Attracting good quality trainees and efficient future range officers and assistants requires also a careful consideration of the status of range personnel without which no long-term action could be carried out. Such a possibility might be feasible through the Range Development Fund to be created in the near future. As the proverb goes "honeybees are not caught with vinegar."

An exhaustive check list of the northern Somali plants, their use and ecology should be drawn up with two alphabetical keys, one from scientific names and families to Somali names and one from Somali to scientific names. Basic data are already available (Glover, Gilliland, Hemming). The statement that some of these basic works are not taxonomically up to date is not a very determinative one, since synonymy can be [illegible]. Later on a complete flora with [illegible] identification keys should be carried out

but this is a rather difficult, time-consuming task, and a long-term target. However, it should be started as soon as possible.

Range types should be defined and mapped with the help of aerial photographs and field work, as an essential tool for range development planning, implementation and localisation of possible areas for fodder crops.

Growing fodder crops might appear of little interest to some people wherever there are range reserves. But it must be borne in mind that the production of such crops are many times higher than that of the ranges; they give green feed in the dry season and constitute a desirable technical evolution of the stock owners towards more intensive animal production systems. These fodder crops, after demonstration experiments on a wide scale, could be extended to Range and Livestock Improvement Associations as well as to settled farmers and livestock raisers.

ANNEX

MISCELLANEOUS OBSERVATIONS

1 Geomorphology

The rocky hills and plateau of the Burao, Hargeisa and Borama regions seem to be a huge pediment where the various geological outcrops are overlaid everywhere by a thick lime crust which in the mediterranean region is attributed to upper quarternary (Villafranchien) and known as "Salmon crust of Helicideae" owing to its colour and to the fact that it often contains snail shells.

This seems to have been overlooked so far.

2 Geology

The writer has been struck by the geomorphological and lithological similarities between the middle and lower eocene layers of Erigavo and Berbera regions and the formation in southern Algeria and Tunisia of the same period, where important phosphate mines are located. This might be worth considering.

The Haud region seems to be a huge Karst overlaid by terra-rossa of "decalcification clay."

3 Wildlife

Along the some 3,500 km of my Safaris in the northern region, I have observed:

- about 100 Speke's gazelles - Gazella spekei - (Steppic zone and open woodland mainly).
- 1 Rhim Gazelle - Gazella leptoceros - (sub-desert steppe 50 km E of Berbera).
- about 20 Waller's gazelles - Litocranius walleri - (woodland and open woodland).
- about 200 Dick-Dick - Madoqua saltiana - (woodland and open woodland).
- about 150 Wart hogs - Phacochaerus aethiopicus - (thicket, forest, woodland and steppes).
- 13 Ostriches - Struthio camelus - (steppes, El Afwein, Sillil - Berbera).
- about 30 Baboons - Papio hamadryas - (woodland and forest).
- 2 Klip Springers - Oreotragus oreotragus - (escarpment: Mait Pass and Sheikh Pass).
- 10 Mongooses - Herpestes ichneumon - (farmland, Borama).
- Hundreds of ground squirrels, mainly in woodland and open woodland.
- about 50 Jackals - Canis aureus - (often in pairs).
- about 10 Hares

This may give an idea of the respective proportions and relative density of these species. The size and density of populations seem to be inversely correlated to the vegetation depletion stage.

4 Forestry

In several sites a few Eucalyptus have been observed (E. camaldulensis, E. microtheca) and seem to have a good growth (except, surprisingly enough, in the better rainfall areas of Daloh and Gaanlibah). Between Abdulkadir and Bawn (estimated rainfall 300 mm), a beautiful small plantation of E. camaldulensis and of Conocarpus lancifolius was observed. Planted in 1962, the Eucalyptus reached 15–20 m high and Conocarpus 5–15 m. The site is located in a small depression benefiting from run-in.

A plantation of several hectares of Conocarpus in Berbera is in very poor shape due to soil and water table salinity. This area is suitable for planting Atriplex and/or Tamarix aphylla (maybe T. nilotica could be interesting too).

In order to assess the timber production potentials, a network of aboretums should be set up covering the main ecological areas. They could be located in the same sites as the pasture exclosures; a minimum of co-ordination in this matter between forest and range and wildlife services is highly desirable to avoid duplication (fence, watchmen) and spare funds.

The Juniperus procera forest and remnants either in Gaanlibah, Daloh areas (and elsewhere) are in grave danger owing to cutting, lopping (Sideroxylon) and overgrazing. The trees are old and no regeneration was observed. Though not a professional forester, the writer's opinion as an ecologist is that those forests should be delimited and given a national park status. All exploitation should be stopped.

5 Exclosures

As mentioned before, the exclosure sites were well selected, but, in the writer's opinion, two problems remain to be solved:

(a) To place in each of them a totalizer rain gauge in order to be able to interpret correctly the vegetation changes in the line transects;

(b) To commit a part-time or full-time watchman responsible for possible damage to the fence or intrusion in the exclosures. My own experience in this matter over many years is that both fence and watchmen are required. Further exclosure as well as demonstration plots should be located as close as possible to main roads for reasons of accessibility, control and maximum demonstration value, being thus observed by the greatest possible number of people.

6 Shading

In Berbera, permanent and low maintenance shade for livestock awaiting shipment could be provided by planting Tamarix aphylla trees. Those trees, watered for the first 2–3 years, could very likely tap water from the deep water table and have a quick growth. This tree can reach 20–30 m and give very good shade. They may be planted 5–10 m apart.

7 How to carry out Range-type Identification

As stated in the report, each broad vegetal formation described so far in northern Somalia is in fact a collection of numerous range types with extremely wide differences in value and potential. These range types have to be defined and mapped in order to achieve a sound range management planning. This requires several years' work but it should be started as soon as possible on selected areas within the various ecological zones.

The first step is to take site-plant records. These records are taken along topographic catenas and from their statistical correlation range types and dynamic status can be defined and then mapped.

7.1 Site-plant list records

The following items must be recorded:

- Author's initials
- Record number, date, locality, acreage investigated
- Altitude (Altimeter)
- Topography, slope, exposure
- Hydrology, erosion
- Geology, geomorphology, lithology
- Soil description (as deep as possible) and soil surface characteristics
- Estimated average rainfall and the rainfall conditions of the actual year
- Land use
- Landscape
- Dynamic status

7.2 Vegetation structure (layers or strata)

Layer I	Trees Height>5 m	ground cover %
Layer II	Small trees 5>H>3 m	" " "
Layer III	Shrubs 3>H>0.5 m	" " "
Layer IV	Under shrubs 0.5>H>0.2 m	" " "
Layer V	Perennial tall grasses	" " "
Layer VI	Herbs, forbs, annuals, swards	" " "

Some species may appear in several layers. This gives an indication of the dynamic status (regeneration or depletion).

7.3 Plant list

The plant list is made by layer. Each species is given its scientific and vernacular name. If the species is unknown, the genus or family should be mentioned together with the local name. The information to be recorded on each species is the following:

- Species number in the plant list
- Ground cover, percentage of the total area
- Density (number of individuals per m^2 or per ha)
- Repartition (grouped or isolated)

- ... (seedling, growing, bloom, fruits, rest)

- Grazing or browsing status (poisonous, ungrazed, hardly grazed, grazed, extremely grazed)

- Grazing and browsing animals

7.4 Plant collection

All the species of the site must be collected with several specimens unless their identification is absolutely certain (at the variety level). Whenever possible, specimen should have flowers, fruits and roots (for small species). Each specimen is given a label with author's initials, plant list number and species number in the plant list, the label is attached to each specimen with a sticking tape or a string. The label indicates also the provisional scientific and vernacular names. The plants collected in each particular site are put together in one or several polythethylene bags. In the evening at the camp or in the laboratory, each specimen should be placed between two sheets of newspaper. All the specimens of a given plant list are kept together in a file. The files are piled up, pressed and dried. If necessary, the paper should be changed every 2-4 days. Afterwards, the specimens are poisoned against insects and stored in files (one file per site-plant list record). One specimen of each species in each plant list will be sent to a specialist for identification. Another specimen (same number) will be kept and given the scientific name when it has been established by the above specialist.

7.5 Definition of range types

The sites plant list records are studied statistically (either through tables or through punctured cards and computers). The relationships between the various species and between species and ecological factors are thus established and plant communities defined. The grazing value of each community is computed from plant composition, density and ground cover.

In a further step, production records should be taken in several selected sites of the main plant communities and in relationship to the dynamic status.

7.6 Imaginary example of site-plant list record

Number	LH 220172-05
Situation	10 km south of Sillil
Acreage investigated	2500 m^2 along the track to Borama
Altitude	150 m
Topography	Sandy plain, gently sloping 1-3 percent northward. Microtopography: slight closed depression (0.5 m under plain level) 150 m wide
Hydrology	Run-in, wet in depth at 0.3 m under ground level
Geology	Alluvial depression in quarternary, gravelly pediment

Soil description	Soil surface 30 percent bare, light wind erosion
0–30	...course sand slightly silty; Hcl weak; no structure, many roots; almost dry after 5 cm; colour 10YR 4/3
30–120	30–120 sandy loam subangular blocky, numerous roots, colour wet 7.5YR 5/3; fairly wet; Hcl very strong; 10 percent limestone gravels
120–150	Limestone gravels; rare roots; 20 percent coarse sand; dry
Rainfall	Estimated average 150 mm (Sillil 130 mm) Present situation fairly good. Winter rains in December a few mm (1–5) yesterday
Land use	Pasture
Landscape	Range with open woodland of Acacia tortilis Balanites orbicularis and Lecaniania cornu-technica along the stream network and major depression

7.7 Structure and Plant List

I : 7>H>3 m – C.C.<1 percent

		Cover density		Grazing status
01	Acacia raddiana	0.5	5/ha	FG
02	Balanites orbicularis	0.1	1/ha	G

II and III Nothing

IV : 1>H>0.5 m – C.C. # 10 percent

03	Indigofera cf ruspolii	10%	2/m^2	G
04	Malvaceae sp.	1%	o.o1 m^2	NG

V : 1>H>0.3 m – C ≃ 30 percent

05	Panicum turgidum	10%	3/m^2	G
06	Lasiurus hirsutus	20%	5/m^2	V.G.

VI : H<0.5 – C ≃ 30 percent

07	Aristida cf. adscensionis	2%	10/m^2	VG
08	Aristida sp. (annual)	10%	100/m^2	VG
09	Heliotropium sp.	20%	10/m^2	NG

10 Zygophyllum simplex	< 1%	0.1	NG
11 [illegible] brachycarpa	< 1%	0.01	NG
[illegible] cf. undulata	< 1	0.5	NG
13 [illegible] sp. (fl. yellow)	< 1%	0.001	NG
14 [illegible]aceae sp. (fl. blue)	< 1%	0.2	NG

Estimated carrying capacity: 1 sheep/3ha/ 6 months