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DRAFT - TECHNICAL REPORT.

RANGELAND CONSERVATION AND DEVELOPMENT

SOMALIA

RANGE MANAGEMENT (NORTH)

Based on the work of
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UNITED NATIONS DEVELOPMENT
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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The Food and Agriculture Organization of the United Nations is greatly indebted to all organizations, firms and individuals who assisted in the implementation of the Project by providing information, advice and facilities. In particular, mention should be made of the Ministry of Livestock and range and especially of its Range Management Service. The National Range Agency which came into existence during the later stages of the Project is to be commended also.

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CONCLUSIONS AND RECOMMENDATIONS

A. General

Most of northern Somalia, 99 percent, has an average annual precipitation below 500 mm and all but about five percent of the region has an annual average precipitation below 300 mm. The four percent of northern Somalia with average annual precipitation between 300 and 500 mm is the area of upland plateau south of the escarpment above the sub-coastal plain to Tug Wajala and from Hargeisa west to Borama. The immediate area of Tug Wajala and the high, broken, mountainous area along the escarpment(1 percent of the region) have average annual precipitation above 500 mm.

Even 500 mm average annual precipitation at these latitudes is considered marginal for cultivated agriculture in almost any classification system. Certainly, by any classification, the majority of the area of northern Somalia consists of arid, marginal lands not suitable for cultivation except where irrigation is possible.

With few exceptions the lands of northern Somalia are range-lands and, despite the present conditions, can be said to be good rangelands. It is estimated that eighty percent of the range can be improved by nothing more than proper grazing management to a satisfactory (fair to good) condition. The remaining twenty percent will require a long period of natural succession or some mechanical modification before it will reach a satisfactory condition.

It does not seem feasible to convert these rangelands to agricultural lands on a large scale through harvest of runoff water from precipitation. Costs of construction on areas modified for water harvest and conservation are high and the benefit is realized on only ten to twenty percent of the area so modified because the ratio of area of runoff to benefitted area must be between five and ten to one.

If water harvesting and conservation structures are constructed on twenty five thousand hectares of the rangelands in the Hargeisa - Gabile - Borama - Tug Wajala vicinity the benefitted area would be from 2,500 to 5,000 hectares. It can be expected that the results would be a fair yield of Sorghum and Zea mays, say four to five tons of grain and stover per hectare in most years with the average yields being somewhat less that that tonnage. There will be deterioration of the cultivated lands and reduced crop yields due to loss of fertility and to soil erosion resulting from the cropping.

Several thousand hectares of land in the area south of Gabile have been modified for cultivation by construction of water harvesting and conservation structures in the past. From these there has been good harvest of grain and stover, at least during the past two years but the people in the area still depend upon livestock to provide most of their livlihood. These livestock are dependent upon the rangelands outside of this improved area for most of their forage and for most of the year. There is no range management and little or no range improvement facilities have been constructed in connection with this cultivation scheme. As a consequence the range resource in the surrounding area is deteriorating as are the numbers and condition of the livestock.

The twenty five thousand hectares under consideration for water harvesting and conservation could be expected to yield up to 20,000 tons of dry matter including 5,000 tons of grain in good years if the improvements are made purely for crop production. If the twenty five thousand hectares of land were to be improved with water harvesting and conservation structures as an adjunct to range management this work could provide an average of 300 hectares of cultivated land for drought reserves, supplemental feed for livestock and family gardens for eighty cooperative ranches. It could provide permanent homes for 8,000 families, managed rangelands for 320,000 animal units and export income from approximately 20,000 animal units.

From the ecological information available it must be recommended that, for the best economic and social return from the land for the Somali people, the majority of northern Somalia should be utilized as rangeland with proper management. As an aid to range management a small percentage of the land should be improved with water harvest and conservation structures for cultivation of fodder crops and family gardens for producing vegetables, fruits, grain and forage for milking stock.

B. Specific Conclusions

a) The industry which employs the most people, furnishes the largest portion of the most important food for the people of Somalia and which brings in the most money from outside the country is the range livestock industry.

b) The livestock industry is dependent almost entirely on the range resource for its existence.

c) Due to many changes which have taken place and are still occuring in the political and social environment of the country, the traditional range management practices of nomadic livestock herding people can no longer be followed.

d) As a result of the lack of management under the traditional system and in the absence of any alternative system of management the range is being overused. There are many indications that the range resource is being badly damaged. The trend on the range is toward less forage production due to the deteriorating condition of the forage plants. There are large areas of bare soil and extensive areas of accelerated soil erosion. Cover of the soil by the basal area of the plants is as little as 0.5 percent on much of the range and production of available forage may then be as little as 100 kg per hectare.

e) To insure that the livestock industry remains vigorous it is imperative that the range be put under some form of management that will provide for periods of rest from use of the vegetation so that the important forage plants can regain their vigour. Vigorous plants can increase in size and number and thus reverse the present trend toward less production of forage. An increase in plant cover can protect the soil and reduce runoff of water from precipitation which will improve conditions of the environment for plant growth.

f) No improvement practices on the range such as providing additional stock water, revegetation programmes, water harvest and conservation or any combination of these programmes can be effective unless there is management and control of the livestock.

g) No management control can be effectively initiated until the livestock owners are willing to cooperate . The livestock owners will not cooperate until they have some assurance that they will benefit by the new management practices. There is now in the north of Somalia a significant nucleus of livestock owners who desire to settle their families and obtain use rights to a specific part of the range. To do this they are willing to accept membership in range cooperatives and handling their livestock under a specific management plan.

C. Recommendations

a) All possible emphasis by the National Range Agency should be put on firm establishment of the range cooperatives now organized and operating in the Erigavo and El Afwein Districts in order that the feasibility of this livestock management system can be tested.

b) As soon as there is good evidence that the cooperative ranch idea is a proper step toward management of the range resource in Somalia, there should be a strong drive initiated toward establishment of ranch cooperatives throughout northern Somalia.

c) Cooperatives should be of three types as provided for in the Cooperative Ranch Act: a) True grazing ranch cooperatives whose members are rural livestock owners from nomadic or semi-nomadic peoples; b) Cooperative of urban livestock owners who presently live in the villages or towns and now herd their animals in and around these centres: c) livestock trader cooperatives made up of the people who buy livestock from the herd owners and accumulate this livestock to be sold on the international market as buyer demand and sea transportation is available.

d) Land as necessary should be delimited and managed as stock routes from among the cooperatives to the market areas and shipping points. Such stock routes should be managed in rotation in a system similar to that recommended for other rangelands.

e) All rangeland except that in Government ranches, Government holding grounds and Government fodder cropping areas(producing fodder for the export trade) should be put into one of these cooperatives so that there is no vacant land. All livestock owners should be members of cooperatives so that there are no livestock owners using the range without established rights.

f) All established grazing reserves should be put under a rotation grazing system which will insure that one fourth of the reserve area receives two consecutive years rest from grazing during each period of eight years. As the range area surrounding an established grazing reserve is taken up by cooperatives the grazing reserve area should be converted to either a government ranch or a grazing cooperative.

g) Cooperative members should have no alternative to keeping their livestock under their particular management plan in their own area. Only if the individual members and individual cooperatives are able to survive and improve their own range area can the entire range area be improved.

h) Additional stock waters should not be developed on the range except under a management plan in one of the above recommended system. However, after an area is put under a management plan sufficient water must be available to allow implementation of the plan. Sufficient water means, in most cases, at least one permanent water per cooperative ranch and one temporary runoff water catchment

in each of the rotated grazing units of the management area. Additional water structures should be developed as sites, time and resources allow.

i) A management system employing four rotational grazing units each of which is rested for two consecutive years and grazed by the proper number of livestock for six years will be sufficient to reverse the deteriorating condition of the range and bring about some recovery. The Government ranches of various types should be used as research areas to test other management systems in order to discover the best system for Somalia rangelands.

I. INTRODUCTION

The UNDP/FAO Project SOM/72/003 had as its long range objectives the task of finding means of reversing the process of deterioration of the productivity of the Somalia rangelands and of finding the best use of the vegetation, livestock and water resources of the country. More specifically the immediate objectives of the project in the north of Somalia was to emphasize the programme of "development of fodder production on sites where the soils and vegetation have been modified to harvest and conserve water, to carry out field trials on introduced fodder species and to improve and increase the area of grazing reserves".

The range ecologist for the northern project area had as terms of reference to: "Set up soil and water conservation areas as demonstration sites, to plant wet and dry season grazing reserves, coordinate the activities of the experts in soil and water conservation, range management, establishment of nurseries and field trials and to assist consultants in eco-system model studies".

Between the time of writing the Project Document and the arrival of this staff member the country had experienced a severe drought and conditions of the people and their livestock were critical. As a result the Government had to take emergency measure and action and made some special requests through the Project Manager.

A request was made of the range ecologist to formulate as soon as possible a management plan for the grazing lands of an established agricultural cooperative. Another request was for estimates of the range production of northern Somalia.

At an early stage it became evident that traditional system of livestock grazing with no attention to proper stocking or other range management considerations was the basic cause of the serious deterioration of the rangelands. This prognosis came about from studies made while developing the management plan for the El Barda Cooperative, from observations made while carrying out other dutie and as a result of visits, discussions and trips made at the request of and with the Range Director. It became apparent that a new system of range-livestock management which would affect the range, the livestock and the people who own livestock was needed. It was recognized that sites could be developed for soil and water conservation with possible increases in forage production, new stock waters could be developed, new plans could be m of rock and and grown in selected sites and additional grazir ck on the grazir these efforts fail to reach the heart of the pr be buil likely have little effect on the range, the liv the people involved if traditional grazing pract unchanged. This was implied through out the repo

D. Thornton at the close of the survey of the Northern Rangelands Project in 1972. No improvement in the condition of the rangelands, the associated livestock industry nor in the conditions of the people who own livestock can be made until there is management of the range and control of the livestock.

A. Studies

As specified in the project document, much of the project work in the northern part of Somalia was done on sites chosen for demonstration of the possibilities of harvesting runoff water from precipitation and conserving it for the use of forage plants. Work has been done at Dumal-Caasha Cado, El Bardale, Haleya, Far Janno, Silil and Shamale.

At Shamalle only a small amount of work was done because only a few of the farmers on the site would agree to use the area for improvement and demonstration. At Silil considerable planning work was done and the vegetation of the area was mapped and measured. However, the engineering work required was far beyond the capabilities of the projects manpower and equipment. Because of political difficulties the work at Far Janno was not completed after considerable modification of the site and the valley was left in an unsuitable condition. Some work on production and carrying capacity was started at Far Janno and trial plantings of sorghum and sudan grass were made. This had to be abandoned when the project was told to leave the site. Considerable work has been done at Haleya using both hand labour and machinery on the soil and water conservation improvements. Many trial/demonstration plantings of various fodder species were made and some harvest was completed. An intensive ecological study of the plant communities was made at Haleya. At the El Bardale site, work was done to direct water from an ephemeral stream bed into a canal which was built to carry the diverted water onto a ten hectare site. The planting site was improved with a system of cropping basins and waterways designed for the production of drought reserves forage and supplemental feed.

Studies of the production of forage plants were made on the grazing area of the El Bardale Cooperative land and the results led to estimation of proper stocking rates and the formulation of a grazing management plan. A water catchment dam of rock and cement was constructed to store water for livestock on the grazi area. Sites were chosen for three other dams to be built by workers of the cooperative.

West of Borama, in the Jir Jir grazing reserve, water conservation bunds were constructed over an area of some 5,000 hectares.

On the Dumal Caasha Cado site an area of approximately 500 hectares has been enclosed and improved with water spreading and conservation structure. Runoff water from an upland, basin-like area of 1,500 hectares above the improved site is to be diverted from the stream channel so the water may be trapped and conserved for fodder production.

The range ecologist had a minor role in the evaluation, planning and initiation of development work of the B-n Gaha site. This is a scheme for fodder production by irrigation with fairly salty water from a solution hole within a large gypsum basin.

The range ecologist assisted in selecting, delimiting and fencing two research-study-demonstration sites to be used in conjunction with the Range Institute at Burao. On one of these sites, near Sheikh, a location was chosen, a design and plan was made and work initiated on a water catchment dam of rock and cement for storage of stock water.

Production and utilization studies have been carried out in a few locations across northern Somalia using meter square quadrat and clipping and weighing the green forage. Dry weight was obtained by drying samples of the clipped forage to obtain moisture percentage.

A grazing management plan has been developed for the livestock Development Agency holding ground at Qol Cady.

B. Surveys

Surveys have been made on range sites at Xuberya, Dagar, Shidalaha, Dur Madeare, Gar Gar Madare, Kalbooca, Karinbihood, Armale, El Surad, Jahak and laba Dar Sotle. These surveys were made to determine the suitability of the sites for cooperative ranches or for Government ranches. Follow-up of this work will be continued by the National Range Agency under auspices of the Kuwait/IBRD loan Project for Development and Improvement of ranges in three regions of the north.

III. RESULTS AND DISCUSSION

A. Soil and Water Conservation

At Dumal-Caasha Cado work was begun on the soil and water conservation structures in late 1974. For the most part this work has been a success, however, the diversion structures in the waterway do not effectively spread the water but only divide the stream into two parts. As a consequence there is some damage to the downstream diversion structures from almost every spate. It is proposed that a sill dam sixty metres long and two metres high be constructed in the gap just above the first of the existing diversion structures. Such a sill dam should help spread the water thus reducing the likelihood of damage to the downstream structures. It would also serve as a water storage dam to supply water for domestic use and for livestock. A plan has been completed for this sill dam but the structure had not been built at the time of premature termination of the Project.

The Dumal-Caasha Cado site has been closed to livestock grazing for two years. With this protection and with the additional water harvested and spread the modified portion of the site which receives extra water is producing an average of dry forage of 848 kg per ha. (Table I). This would amount to 950 kg per ha if the approximately four ha of bare soil are not included in the calculations. The area of bare soil has not shown any appreciable improvement with the rest from grazing. There was an experimental planting of Cenchrus ciliaris on the bare area, however, the experimental plots were accidently destroyed by cultivation for trials with sudan grass and the experiment was lost before results were obtained. Trials with sudan grass were not successful at this site.

As a result of the two years of rest from grazing the forage plants at the Dumal-Caasha Cado site have regained in vigour and on the part not receiving extra water forage production is averaging 340 kg per ha. On the surrounding area with no protection from grazing the forage production is only 140 kg per ha.

At Borama in the Jir Jir grazing reserve the soil and water conservation structures have not been effective. The bunds were too low, many were improperly constructed or were not properly located (not on contour) or both. The area was never closed to livestock and the animals have considerably damaged the structures by trailing over them. Some of the modified area was taken over by farmers for cultivation. In some of the cultivated plots the bunds were destroyed by farmers. The cultivation allowed increased runoff which destroyed other structures below and initiated some gully erosion.

At the Haleya site there has been approximately 300 ha improved by soil and water conservation structures. The area is now being enlarged. Aloe spp. and Acacia edgeworthii plants are being cleared from the improved area. Sudan grass has been planted in strips within the 10 metres directly above the water holding structures. Manure and bone meal have been used as variables in the experimental plantings to evaluate the production potential of the site. There has been some harvest of the sudan grass. A stock water pond was built at the Haleya site but has caught little water to date. Haleya has been the most successful of the soil and water conservation developments in the northern part of the Project area. The structures were adequately designed and were well built. There has been no damage to the structures because of runoff or livestock.

Far Janno is a site located in the upper end of a small, alluvium filled valley and is typical of the upland topography of northern Somalia. It is believed that such valleys are suitable for harvest of runoff waters which can then be used for growing forage for drought reserves, supplemental feeding or for growing gardens for the people who settle there. These sites are near the head of the waterways and the runoff from surrounding hills is not difficult to control and harvest. The soils of these valleys are relatively fertile.

Far Janno was representative of areas on which it was planned to recommend water harvest techniques on the cooperative ranches and the site was chosen to be a model for modification work for forage production and gardens. The Far Janno site was near the project headquarters and the farmers in the valley area were willing to do the work as planned.

Planning and engineering for modification of the Far Janno area was intensive(too intensive as it turned out to be a model for the cooperative ranches). Work was begun on the area in October 1975. When heavy equipment arrived at the project site it was first located at Far Janno. Work continued until June 1976, however, as early as March there was criticism of the projects presence in the area. The criticism only reached us as rumors and seemed to be without official connection until May, 1976. Indeed we believed, until early May that we still had official approval for the work as we surely did before the work was started.

The work as planned for Far Janno was about one-half completed by the first of June 1976 when the project received specific orders to halt activities and take all project equipment away from the area. The site was not left in satisfactory condition due to stoppage before completion of the plan and the seasonal rains caused considerable damage to the valley where the work had started.

The Silil site was examined at the insistence of Government officials and never really fitted into the work outlined in the Project Document although this fact was not clear at the outset. The area was accepted by project personnel for survey to determine if it could be modified into a soil and water conservation site. Considerable time was put into a land survey and an engineering plan for the Silil area according to understanding of the project personnel. Two months were spent on study of the vegetation and soils at the site. Also some survey and planning was done toward development of livestock water structures and management planning for grazing use.

The Silil site, as project personnel saw it, was so large that it was beyond the man power and equipment resources of the Project. The plan was for the project to attempt to develope some 1,500 ha as an initial step, however, there appeared to be a great deal of misunderstanding as to size and purpose of the work from the start. Work on development at the site was never started due to lack of personnel and equipment. The engineer who made the designs and planned the work was removed from the Project in April 1976.

The Shamalle site was one of the first chosen by the soil and water conservation expert for improvement work, however, no solid agreement was ever reached with the farmers occupying the area. As a result of this lack of agreement, and although the development plan was completed, there was little actual work done and the site had to be abandoned.

B. Government Ranch Sites and Cooperative Sites

At El Bardale the work was good on the diversion sill dam, the intake gate, the canal and the cropping area. The work appeared to have been adequately planned according to the limited information available on runoff and spates. Unfortunately, there were three large spates in one week during 1976 which were reported to have been the largest observed by the people over the twenty years the cooperative had been operating. These spates overtopped the gate to the canal and the adjoining barrier and these structures were washed away. The canal and waterways were designed to handle one cubic metre of water per second. When the water overtopped the gate and barrier there was approximately twelve cubic feet of water per second moving through and over

the canal and on to the cropping area. The canal was badly damaged as were the waterways and water holding structures in the cultivated area. The diversion dam was also washed away during these spates.

The water storage dam built at El Bardale for livestock water was constructed of gabion baskets filled with rock. The dam was built on a rock outcrop and the upstream side of the dam was plastered with cement to seal the dam to the bedrock and form a watertight structure. The dam was built so that it filled with alluvium during the first two or three spates. Water is then stored in the sand and taken out through a pipe built into the bottom of the dam.

The management plan developed for the El Bardale grazing area was put into practice in November 1975. The grazing area had at that time been rested from use for two years so that forage plants had regained their vigour. To date the plan is being followed and seems to be adequate for bringing about improvement of the range.

The Xuberya site, in the Sanaag Region east of Erigavo and east of Buran, has been proposed by the Government range personnel as a Government livestock ranch. Until late 1971 this large basin-like valley was occupied and used for livestock grazing by the people of the village of Xuberya. The valley acts as a sink for runoff water from a large watershed area. The Hadaftimo Tug which terminates here drains a large part of the escarpment which passes to the north of Erigavo. Smaller, shorter water courses from the plain to the west and the hills to the south also empty into the valley. Previous to the cyclonic floods of 1971 the water spread widely across the northern part of the valley floor making a well watered grassland for livestock. The floods that destroyed the village changed the water course and changed the direction and location of the water spreading. The area now benefitting from these spates is much smaller and less productive than formerly.

It is desired to divert most of the water from the spates back into the old channel and thence back to the previous spreading area. This may be possible by constructing a rock and cement sill dam across the stream channel well above the point where the new channel takes off in order to divert most of the water on to the valley floor to the north of the channel. The dam would also make an excellent water storage dam for livestock use.

The Xuberya valley contains approximately 10,000 ha and this area, together with the surrounding uplands would make a good livestock ranch. It is believed, however, that if the Agency wishes to make a government livestock ranch here the entire valley area with the surrounding hills should be kept as one ranch.

There is a good well with diesel pump at the old Xuberya village site. There are also several possibilities for harvesting water for livestock use. It is estimated that a proper stocking rate would be nine ha per animal unit plus an additional three ha per animal unit for implementing a rest-rotation management plan.

Dagar, Shidalaha, Dur Madare, Gar Gar Madare, Armale and Damay are fully organized Cooperatives with chosen and tentatively designated sites for their ranches. Kalbooca, Karinbiyood, Armale, El Surad, Janhak and Laba Dorsotle are proposed cooperative ranches in the process of being organized. These latter cooperatives have located sites for development of water harvest and spreading structures. There has been some work done on the seven organized cooperative sites. There is presently a counter-part soil and water conservation technician stationed at Erigavo and he has been provided with seven foremen trained by the Projects soil and water conservation expert. One of these foremen is working with the cooperative members of each of the cooperatives. Although these men need technical assistance from well qualified soil and water conservation engineers, the work is progressing well.

The Dagar Cooperative Ranch has claimed a part of the upper end of the Shidalaha valley. This valley receives much of the runoff from the high hills of Erigavo, the highest rainfall in northern Somalia. There is no permanent stream but the cooperative area receives considerable water from spates and the valley area is very productive. There is some gully erosion starting within the cooperative area but so far there has been little real damage. Development of fodder crops and garden area with construction of water harvest and conservation bunds should stop this erosion. Two small dirt fill dams have been constructed near the head of the gully in order to store water for livestock. These dams will also aid in stopping the head-cutting of the gully. There are three permanent waters within the Cooperative area for domestic and livestock use.

Fifty three families have been organized into the Dagar Cooperative Ranch and they have 5,000 sheep and goats, 100 cattle, 73 camels and 46 donkeys. A total of 1,220 animal units. It is estimated that the area will support one animal unit per six ha and with an additional two ha per animal unit needed in order to implement a rest-rotation management plan the cooperative area should be 10,000 ha. There will be 250 ha developed and improved by soil and water conservation structures for use as family gardens and production of drought reserves and supplemental feed for livestock. Most of the fifty three families have already established semi-permanent homes in the area.

Dur Madare Cooperative Ranch has been located near the head of a small valley originating on the gypsum plain southeast of Erigavo. Rainfall for the area is low(approximately 150 mm annual average) but percentage runoff from the plain is high. There are approximately 200 ha of valley for fodder crops for drought reserves, supplemental feed for livestock and family gardens. The cropping area is on relatively good soil and is quite productive but there is a very severe erosion problem. There are gullies developing in several locations in the valley and a very large gully is cutting up toward the lower end of the cropping area. An earth-fill dam has been constructed just below the cropping area for stock water entrapment and the excess water coming into the dam basin will overflow through the spillway onto another cropping area. This dam will aid somewhat in stopping the head cutting of the big gully, however, there is grave danger that the cropping area will be destroyed if extensive erosion control work is not accomplished soon.

The rangeland surrounding the area is not very good. It is estimated that it will require 16 ha to support one animal unit with an additonal four ha per animal unit required for the implementation of rest-rotation management. The area which has been chosen for the Dur Madare Cooperative Ranch measures 6,400 ha. Presently there are seven families in the Cooperative and they own 230 animal units. The number of members is small to work efficiently on a cooperative development basis, however, the members are relatively wealthy business men from Erigavo and they will be able to hire labour for the work.

There are no permanent water sites on the Dur Madare Cooperative Ranch area. There are some dug wells in the surrounding range area but efforts to find water within the Cooperative area have so far not been successful. A small berked for storage of harvested water from runoff is being built near the headquarters. The soils of the valley contain appreciable amounts of clay and the basins behind dirt-fill dams should conserve any water that is caught for considerable periods.

The Gar Gar Madare Ranch Cooperative has claimed the land directly below and adjoining the Dur Madare Ranch Cooperative and the cropping lands for the two Cooperatives extend across the same valley. The gully which is presently threatening the cropping lands of the Dur Madare Cooperative begins at the very upper end of the Gar Gar Madare Cooperative land and the cropping lands of the latter Cooperative are being damaged by sediments from the eroding area. There are approximately one thousand ha of valley land within the area claimed by the Gar Gar Madare Cooperative which are suitable for improvement with water conservation bunds, however, improvement work is needed at an early stage if the cropping is to be successful.

The rangelands of the Gar Gar Madare Cooperative are much better than those of the neighbor above. It is estimated that it will require twelve ha to support one animal unit on this range and an additional four ha will be needed for implementation of a rest-rotation grazing use plan.

There are fifty families who have formed this Gar Gar Madare Cooperative. They have 2,500 animal units so 40,000 ha will be required to support these animals under the rest-rotation system. There are now two permanent watering places within the area and there are several more sites suitable for constructing dirt-fill dams to hold livestock water. Some work has begun on the improvements for conserving water to produce fodder crops. A fairly large amount of work must be done on the area to control erosion and this should be done as rapidly as possible.

The Armale Cooperative Ranch has chosen land just north of the Armale village within and on either side of the Gulmale valley. The valley land has a fair cover of bunch grasses dominated by Dactyloctenium radulans and the surrounding uplands have a fair cover of grasses in open savanna woodland of Acacia busseyi, Sporobolus ruspolianus, S.variegatus and Andropogon kelleri.

There are about 250 ha of the valley area which can be improved with water spreading bunds for fodder crop production and family gardens. There are no permanent waters on the Cooperatives land. The counterpart soil and water conservation technician has supervised construction of a small dirt-fill dam

on the area for storing livestock water. There is a water well at the village of Armale which is very near to the Cooperative land.

It is estimated that nine ha of the rangeland will be required to support one animal unit and an additional three ha will be needed for implementing the rest-rotation grazing plan. The people of the Cooperative, forty families, have 8,000 sheep and goats, 250 cattle for a total of 1,800 animal units and require 22,200 hectares of land.

The Dumay Cooperative Ranch is located in a short valley just north of the middle section of the Shidalaha valley approximately 40 km south of Erigavo. There is a fair grass cover on part of the valley but there is also bad gully erosion in the lower end of the valley which is the lower half of the Cooperatives land. This gully is endangering the cropping area of which there are about 300 ha suitable for improvement to produce drought reserve fodder, supplemental feed and gardens. There is no permanent water on the Cooperatives land but there is a permanent water hole in a gypsum sink adjoining the land which is shared with the pastoral livestock. Some work has been done and more in progress on water spreading bunds and a tractor has been recently acquired to work on the erosion problems. The Cooperatives lands include a total of 1,400 ha. It will require nine ha to support one animal unit plus an additional three ha for the rest-rotation management so the area could carry 116 animal units. There are no livestock on the area at present.

The remaining Cooperative Ranches: Kalbooca, Karinbiyood, El Surad, Jahak and Laba Darsotle in the Sanaag Region proposed by the potential members and the regional and district authorities were examined by Project personnel and judged to be suitable for Cooperative Ranches. These five Cooperatives have not yet been fully organized and approved.

The proposed Kalbooca Cooperative Ranch, just north of El Afwein, is being organized by 36 families who have 4,600 sheep and goats, 148 cattle; 300 camels and 20 donkeys for a total of 1,500 animal units. The area will support one animal unit on nine hectare and an additional three ha is needed for the rest-rotation plan. The Cooperative, when approved should be allowed 18,000 ha. The proposed valley has a suitable site and area for water harvest and spreading for fodder production and family gardens, however, there is bad erosion and gully development in the valley which endangers the entire area. Erosion control work should be done as soon as possible. It was indicated that there was a small, permanent water supply in the stream course but development of water should have a high priority when work is started on the approved Cooperative.

The proposed Karinbiyood Cooperative Ranch is being organized with 264 families on the Karaman Plain southeast of El Afwein. The number of families is quite large, however, the proposed location has sufficient area for both range and improvement of suitable sites with water harvest and spreading structures to aid in fodder production and for family garden plots. The people are some of those who lost all or almost all of their livestock during the past drought. These people have already begun some improvement work on the cropping area. They grew considerable fodder and some grain during the last wet season. The people now own 18,000 sheep and goats; 80 cattle, 30 donkeys 1,200 camels and 4 horses for a total of 5,300 animal units. If they are permitted to bring their animal numbers to the average allowed for the other Cooperatives they would then have an average of 40 animal units per family or 10,560 animal units in the Cooperative. The area will require approximately 12 ha to support one animal unit plus the four additonal ha needed to implement a rest-rotation management plan. The Cooperative should be approved with an area of 169,000 ha. There is essentially no water on the proposed developed area and establishing water points, largely with dirt-fill dams, should receive priority attention when the cooperative is approved.

El Surad Cooperative Ranch is being organized with 104 families on the El Gore Plain 45 km southeast of Erigavo and near Aramo hill. This Cooperative, if approved, will adjoin the Gar Gar Madare Cooperative on the northeast except that a corridor has been left between the two boundaries for a stock route. There is a suitable area for fodder cropping to produce drought reserves, supplemental feed and for family gardens at the upper end of a small valley at the west foot of Aramo hill. This area is small but there are two other suitable locations for cropping and gardens on the proposed Cooperative Ranch area. One of the alternative areas is approximately ten km north of Aramo hill just inside the north boundary of the Cooperative area. There are other areas suitable for improvement for cropping with water spreading bunds along the Jifdali watercourse near the proposed east boundary.

The range around the Aramo hill is generally in fair to good condition and will require nine hectares to support one animal unit plus three additional ha for implementation of rest-rotation management. The prospective members of this El Surad Cooperative Ranch own 20,800 sheep and goats, 1,560 camels, 520 cattle, 150 donkeys and 20 horses, or a total of 6,750 animal units, and will reqire 81,000 ha of rangeland. There are two permanent waters on the proposed area but additonal waters will be needed and should be developed as soon as possible. There is only one area with serious erosion problems, an area of approximately 200 ha near the northeast corner of the proposed cooperative ranch area. If dirt-fill dams are located on this erosion area for storage of runoff water the problem will probably be solved.

The proposed Jahal Cooperative Ranch is northeast of Got Anod and adjoins the already established Sheikh Shank Agricultural Cooperative. There are 60 families interested in forming the Jahak Cooperative Ranch. The area is suitable for establishing a Ranch Cooperative and there is suitable valley in which to dévelope water harvest and conservation structures for cropping. There is one good, permanent water for livestock and domestic use. The lower end of the valley in which cropping is proposed has two large gullies, approximately 10 metres deep with active head cutting, which are a threat to the entire valley including the Agricultural Cooperative area. Control of these gullies will be difficult.

The members of the propósed Jahak Ranch Cooperative own 11,000 sheep and goats, 80 cattle, 570 camels, 96 donkeys and 5 horses for a total of 3,058 animal unit. It will require nine ha of this area to support one animal unit plus three ha per animal unit to allow implementation of a rest-rotation grazing sys-tem for a total of 36,700 ha.

The proposed Laba Darsotle Ranch Cooperative is being organized by thirty families and they propose to obtain rights to part of the Suf Dheere valley and the surrounding hills for their use. These 30 families own 6,200 sheep and goats, 94 camels, 21 donkeys and 20 cattle for a total of 1,390 animal units. They will require nine ha to support each animal unit plus three ha additional for the rest-rotation grazing management system. Thus, a total of 16,700 ha would be needed for the Cooperative.

C. Plan for Formation of Cooperative Ranches

If the ranges of northern Somalia are to be properly managed and the livestock properly controlled the entire range area, all of the livestock and the livestock owners must be regulated. The means of regulation must allow for all necessary situations and conditions necessaryfor the operation of a livestock industry.

One possible means of achieving management of the rangelands and livestock compatable with the political and social conditons existing in Somalia is by organization of livestock owners into cooperatives to the extent that the range is occupied and used by people and livestock with rights granted by the National Range Agency to Cooperative Ranch members.

It seems that three types of Cooperative Ranches are necessary to cover most of the conditions under which livestock are kept in Somalia. The largest type cooperative, in number of cooperatives, area of the range occupied and number of people will be true livestock raising ranches whose members will be pastoral people. These people, historically and presently, are the livestock raising, livestock herding people who use the rangelands to the greatest extent.

The second type cooperative will be composed of the people who live in the towns and villages and who keep cattle or sheep and goats and who presently allow the animals to forage in and around the villages and towns.

A third type cooperative will be made up of people who do not normally raise livestock but who trade in the livestock industry buying animals from the pastoral people and selling these animals for export. Groups of such traders can form cooperatives on suitable rangeland conveniently located for trading. These latter cooperatives will be operated on holding grounds under rotation management and with proper rates of stocking. The cooperative area will be used only for part of the year, usually not grazed during the growing season, and as a consequence of the shorter period of use the area will be used by a relatively larger number of livestock.

In addition to the three types of cooperatives there should be a net work of stock trails or routes so that livestock may move between the ranches, towns and markets. These stock routes should be planned and designed so that they can be managed on a rest-rotation system.

D. General requirements for Cooperatives

The cooperatives will require rangeland sufficient for the livestock belonging to the members to be kept on the cooperaive

area. The number of livestock and the area of range necessary for supporting them will vary from one cooperative ranch to another.

From interviews with the prospective cooperative members, a sample of 762 families, it was determined that there was an average of 45 animal units per family in northern Somalia. The range in numbers was 31 to 64 animal units per family. From information available to him, Kuneman (personal communication and in his preliminary Trip Report to the Director of Planning, 1976) estimated that there was an average of 300 hectares of rangeland per family in the middle regions of northern Somalia. Until there is more information or until some conflict developes it is believed that any newly formed cooperatives should not be allowed more than 40 animal units per family.

Each cooperative will be established with sufficient suitable land which can be modified and improved to produce fodder crops for drought reserves, for supplemental feed and for family garden plots. The cooperative members will settle their families near the cropping area and each family will be allotted approximately one hectare of the cropland area. These one hectare plots will be used by the family to produce grain and such other food crops that may be grown as well as supplemental feed for one or two animals to produce milk for the family.

In addition to the family garden plots the crop land should be sufficient to produce one hundred kg per animal unit for all of the cooperatives animals. This should require approximately three hectares per family to produce sufficient fodder for forty animal units to be held as drought reserves or used for supplemental feeding. The three ha per family will be held and worked as a unit by cooperative members in common and the produce will be held in common. All work on the area will be a joint project as will the development of livestock waters. Erosion control and land rehabilitation work will be a joint cooperative project also.

There should be one, good permanent water near the settlement for domestic use and for livestock water. There should be developed as soon as possible one reliable water point for each pasture unit of the cooperative so that a rest-rotation grazing system can be initiated.

It is estimated that the water harvesting and conservation work will require approximately 100 cubic metres of structures per hectare and approximately 50 man days of work per hectare for improvement of the land for fodder cropping.