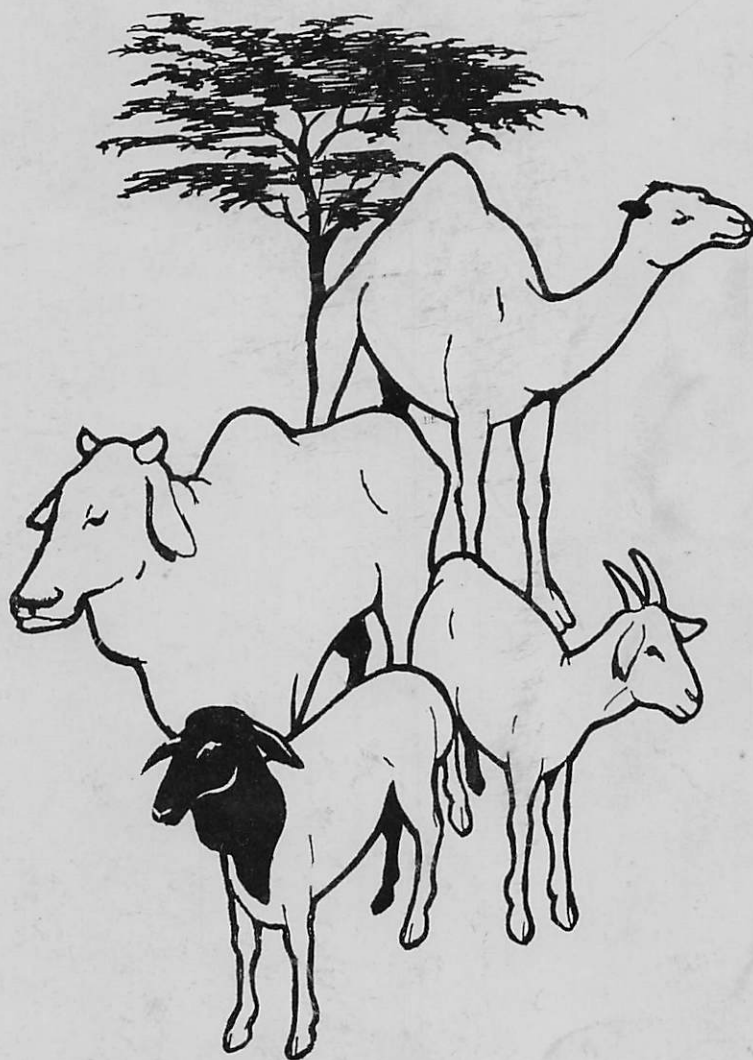


SOMALI DEMOCRATIC REPUBLIC
NATIONAL RANGE AGENCY

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II — PROJECT PREPARATION REPORT



ANNEXES

CENTRAL RANGELANDS DEVELOPMENT PROJECT
PROJECT PREPARATION COMMITTEE

SOMALI DEMOCRATIC REPUBLIC
NATIONAL RANGE AGENCY

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II - PROJECT PREPARATION REPORT
FINAL

ANNEXES

DECEMBER, 1986

CENTRAL RANGELANDS DEVELOPMENT PROJECT
PROJECT PREPARATION COMMITTEE

LIST OF ABBREVIATIONS

AFWTC	Afgoi Forestry and Wildlife Training Centre
APC	Agro-Pastoral Complex
CGDP	Comprehensive Groundwater Development Project
CRDP-I	Central Rangelands Development Project Phase I
CRDP-II	Central Rangelands Development Project Phase II
DALF	District Arid Land Forester
DEO	District Extension Officer
GOS	Government of Somalia
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit
IDA	International Development Association of World Bank
IFAD	International Fund for Agricultural Development
ILCA	International Livestock Centre for Africa
MLFR	Ministry of Livestock, Forestry and Range
NRA	National Range Agency
PMU	Project Management Unit
RLA	Range and Livestock Association
SAPRWS	Saudi Arabian Programme for Rural Water Supply
SIMP	Systems Investigation and Monitoring Programme
T & V	Training and Visit - Extension Methodology
USAID	United States Agency for International Development
VEW	Village Extension Worker
WDA	Water Development Authority
WFP	World Food Programme

CURRENCY AND EQUIVALENT UNITS

Somali Shillings (SoSh) = 100 cents
 US\$1.00 = SoSh 85

FISCAL YEAR

January 1 - December 31

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

LIST OF ANNEXES

ANNEX 1	:	Range Management and Systems Studies	18
ANNEX 2	:	Extension	22
ANNEX 3	:	Agro-Pastoralism	16
ANNEX 4	:	Livestock Production and Animal Health	11
ANNEX 5	:	Water Development	8
ANNEX 6	:	Institutional Arrangements	6
✓ ANNEX 7	:	Prices and Costs	31
✓ ANNEX 8	:	Models and Project Benefits	39
ANNEX 9	:	Terms of Reference for Technical Assistance and Senior Staff	23
✓ ANNEX 10	:	Project File References and Bibliography	Δ

176

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

RANGE MANAGEMENT AND SYSTEMS STUDIES

RANGE MANAGEMENT AND SYSTEMS STUDIESTABLE OF CONTENTS

	<u>Page</u>
A. INFORMATION AND UNDERSTANDING REQUIRED	1
B. SYSTEMS INVESTIGATION AND MONITORING PROGRAMME	1
General Organisation	1
Production Systems	1
Multi-Disciplinary Team Effort	1
SIMP Team Training	2
Use of Light Aircraft and Base Camps	2
Integration with Phase I Activities	3
Phased Development Approach	3
Systematic Reconnaissance Flights	3
Systematic Regional Reconnaissance Flights	4
Uses	4
Miscellaneous	4
Range Management and Soil and Water Conservation	4
Livestock Production and Health	5
Pastoral Production	5
Pastoral Husbandry	6
Agro-Pastoralism	6
Pre-Development Survey	7
Management Plans	8
Remote Sensing and Monitoring	8
Remote Sensing Unit	9
C. PHASING OF SIMP PRE-DEVELOPMENT SURVEYS, INTERVENTIONS AND MONITORING	10
Year 1	10
Year 2	13
Year 3	13
Year 4	14
Year 5	14
Year 6	15
D. RANGE MANAGEMENT AND SOIL AND WATER CONSERVATION	15
General Discussion	15
Planned Activities	16
Implementation	17

RANGE MANAGEMENT AND SYSTEMS STUDIES

A. INFORMATION AND UNDERSTANDING REQUIRED

1. Generally, it is important to gain as complete an understanding of a production system as possible. This involves knowledge of:-
 - (a) Major factors influencing and comprising the production system.
 - (b) How these interact within the system.
 - (c) Present status of the system regarding productivity and conservation status.
 - (d) Potential status under optimal management.
 - (e) Potential dangers resulting from sub-optimal management.
2. A knowledge of the above allows judgements to be made regarding the proper nature of management interventions needed to bring about a desired situation (maintenance and/or improvement of conservation status and/or productivity).
3. For example, it is important to know whether a production system (or areas within a system) has potential for increased productivity, has no such further potential but is capable of continued production at its present level, or has little or no productive potential. This kind of knowledge allows "order of magnitude" priorities to be set about the degree of interventional involvement in a specific production system.
4. Production systems with high potential are often more complex and require more study in order to be properly understood than other production systems. The danger of environmental degradation from improper use may also be greater. On the other hand, there is less need to study and intervene in a production system which has little potential for improvement in either conservation status or productivity.

B. SYSTEMS INVESTIGATION AND MONITORING PROGRAMME (SIMP)

General Organisation

5. This systems oriented programme is designed to optimise data collection, analysis and subsequent use of survey and study findings to determine practical management interventions. There are several aspects to this programme.

Production Systems

6. All activities would be carried out within the context of a production system, seven of which have been identified. This would ensure that survey/study results are accurately interpreted and most efficiently extrapolated throughout large areas of the Central Rangelands.

Multi-Disciplinary Team Effort

7. All surveys and studies would be carried out as an integrated effort by a multi-disciplinary team of expatriate experts and their Somali colleagues. Emphasis would be placed on complementarity in terms of type, area and timing of individual studies and surveys.
8. The core of the SIMP team would be four expatriate experts; Range Manager, Livestock Production Officer, Socio-Economic and Rural Development Officer, and Head of the Agro-pastoral Section. These Officers would, with their Somali colleagues, work together as a team to carry out fast and simple

surveys and studies of the most important aspects of each production system. This would be done under the general co-ordination of the Technical Manager, but with the specific and all important assistance of the Development Systems Analyst. The results would be integrated into a working model of the production system which would be used to pinpoint the constraints which are limiting productivity. From this would be developed management interventions likely to overcome these constraints. (Figures 6.1 to 6.4 in Annex 6 show the relationships of all the above).

9. Two production systems would be surveyed/studied each year so that all systems would be studied over a four year period. A beginning would also have been made in establishing a long-term monitoring programme. Only the most important production system attributes would be studied and every possible use must be made of rapid appraisal methods.

SIMP Team Training

10. The expatriate team members would be assisted by, and would provide on-the-job training to, the Somali SIMP staff during the one-year survey/study of each production system. Each system would have its own Somali SIMP team. In the following year the expatriate team would move on to survey/study another pair of production systems. The original Somali SIMP team would remain behind as permanent district CRDP staff. They would be responsible for continuing and extending, where needed, the studies/surveys over the remainder of the district within which the original work was carried out, and for pre-development surveys and developing management plans; initiating and carrying out needed interventions, and continuing monitoring activities. They would continue to be assisted by the expatriate expert team, which would return periodically, but at less frequent intervals than before. (A completely new Somali SIMP team, one per production system, would work with the expatriate expert team in the next two production systems). In order to increase the speed with which staff can be trained, a third Somali SIMP team would remain with the expatriate expert team throughout the entire phase II.

11. At the end of phase II this (third) Somali SIMP team of four senior staff would have been exposed to the complete range of environmental, socio-economic and developmental conditions in the Central Rangelands and would have helped train all district staff involved in developmental work. These staff would be well placed to take over leadership roles in their respective disciplines with Central Rangelands-wide applications.

Use of Light Aircraft and Base Camps

12. In order for the SIMP team to successfully survey/study two production systems per year, as well as continue to train and assist district staff in pre-development surveys (refer para 38), planning, implementation of management interventions and continuation of monitoring activities, it would be essential to move quickly and easily from system to system and district to district whenever necessary.

13. Use of light aircraft would allow large distances to be covered quickly with minimal wear and tear on both vehicles and staff, thereby reducing down time. District headquarters would provide some office and accommodation facilities for the SIMP team, however on many occasions the study area would be a significant distance from district headquarters and daily travel would be inefficient. It would be important for SIMP teams to be well accommodated to ensure a speedy flow of work. Experience from phase I indicates that tents would not be suitable, partly due to the persistent, very strong winds, and the project would provide mobile camps (2) centrally located within each production

system being studied. Facilities would not be elaborate, they would likely comprise heavy duty "contractor-type" mobile vans with an appropriate generator, fuel storage and water tankers, ablution, cooking and accommodation facilities.

14. Fluctuating spatial patterns of attributes, such as vegetation phenology, forage quantity and quality, livestock type and numbers and nomadic population, are characteristic of semi-arid and arid production systems, reflecting similar fluctuations in rainfall, the major natural driving force of these systems. Surveys of these kinds of production system attributes over large areas are best carried out by light aircraft because of the speed and the relative accuracy and, therefore, relative cost effectiveness of aerial censuses.

Integration with Phase I Activities

15. Within the production systems represented by the original priority districts of CRDP-I, SIMP would be involved only in regard to those aspects not fully covered by CRDP-I activities. Examples are agro-pastoral production systems and livestock production.

Phased Development Approach

16. A key aspect of the systems approach to development is the completion of guiding studies prior to development interventions. Firstly, SIMP would develop a rapid overall understanding of a study area within a production system over a year. During this period only a few, locally evaluated, popular interventions would be undertaken to establish good relations with the local inhabitants. Next, the district staff would extrapolate what has been learned by SIMP to the whole district, in pre-development surveys. Thirdly, the major interventions would be undertaken, again using an integrated systems approach. Finally, the long-term monitoring of the production systems and interventions, partially established by SIMP, would commence and provide feedback to evaluate trends and the impacts of the interventions, and to guide future policy. Details of phasing are provided in Section C of this Annex.

Systematic Reconnaissance Flights (SRF)

17. Approach. SRF are carried out by a low-flying light aircraft flying back and forth across an area along systematically placed flight lines. Production systems attributes observed along these flight lines are recorded and expressed within the context of a grid of 5 x 5 or 10 x 10 km² blocks superimposed across the survey area. The relatively small area of the basic sample unit (5 x 5/10 x 10 km² blocks) makes this approach a valuable one for monitoring attributes, the spatial (and numerical) patterns of which change through time. A good example of this is the seasonal changes in type, number and location of livestock, which are responses to fluctuating locations and amounts of rainfall and its effect on forage productivity and quality.

18. Measurable Attributes. A number of different attributes could be measured including, where applicable, types, number, area and location of livestock, wildlife, farms, fallow fields, water sources, houses and huts, enclosures, broad classes of vegetative cover, areas of intense soil erosion and vegetative greenness. Periodic SRF flights over the same area not only allow trends through time to be determined for certain attributes, such as livestock numbers, but also often provide insight into inter-relationships, such as livestock with water supplies or wildlife with vegetation type, or both with vegetative greenness and/or cover.

19. Types of Flights. There would be two types of systematic reconnaissance flights. These would differ primarily in the size of the area flown and,

perhaps, also in some of the attributes recorded. The technique would, however, remain the same in both cases.

Systematic Regional Reconnaissance Flights (SRRF)

20. SRRF would be made over the entire area of the Central Rangelands (149,000 km²) three times during phase II (years 1, 3 and 5). Each flight would be made during the "Gu" rainy season in order to catch livestock at their time of greatest dispersal (hence lowest sampling variation) and when agricultural fields have been planted, are in growth, and are distinguishable from fallow fields. SRRF would provide information on total numbers and areas, distribution patterns and long-term trends of production system attributes throughout the entire Central Rangelands. Following the first SRRF in year 1 of phase II, it would be possible to approximate existing trends by comparing the results with those from the resource inventory of the Central Rangelands carried out in 1979 by Resource Management and Research.

21. SRF would be conducted seasonally over smaller areas (8-10,000 km²) representative of each of the production systems within the Central Rangelands. The principle reason for this approach is to determine seasonal variation in production system attributes. This is essential for a proper understanding of the different production systems, since a major characteristic of each is a seasonal fluctuation in rainfall, forage and crop productivity, and livestock numbers and biomass.

Uses

22. SRRF and SRF data would contribute directly to the development of working models and subsequent management interventions applicable to specific production systems. They, but particularly the SRRF, would also form an important component of a long-term monitoring programme. SRF would provide some of the ground control needed to make the most efficient use of satellite-based remote sensing techniques proposed for CRDP-II.

Miscellaneous

23. A light aircraft would also be used to carry out special "by request" surveys, where needed, for SIMP team members. These would include the taking of low-level, large-scale aerial photographs of small areas, locations of possible water development sites, and checking for trespassers on grazing reserves, etc. A light, high wing 5-6 seater aircraft with a pilot and the necessary navigational equipment would be provided under contract to carry out SRRF and SRF surveys. Another contract would be let for the selection and training of Somali aerial observers, design of sampling methods to meet different survey objectives in different areas, the implementation of initial SRF/SRRF surveys, and initial data analyses.

24. Field landing strips would be constructed within each district. A large 4WD truck would be provided to haul fuel and other equipment for the plane and its team. A personal computer system (computer, monitor, printer, disk drives and software) would be purchased to process, analyse, display and print SRF and SRRF data.

Range Management and Soil and Water Conservation

25. SIMP would concentrate on gaining an understanding of vegetation/soil/land use (such as grazing) relationships. This knowledge would be used to further develop guides for the classification of range conditions and to establish a range condition trend monitoring programme. Range site boundaries

and dominant species would be quickly checked using rapid appraisal methods. Vegetation and soils would be examined along use gradients extending out from villages and wells (heavy use) to more lightly used rangelands far from water and along successional gradients through time following abandonment of farms. This would provide information on indicator species (or other indicator attributes) for classifying range conditions, as well as on the optimal location of permanent range condition trend monitoring plots.

26. The latter would be established within the environmentally most sensitive portions of these gradients to provide the basis for long-term monitoring of range condition trends. Small fenced plots would be constructed within the more heavily used areas near villages to see how quickly degraded vegetation can return to normal. SRF and SRRF survey flights would provide information on location/type/area of highly degraded and/or eroded rangeland.

Livestock Production and Health

27. Staffing. This activity would be directed by the Livestock Production Officer who would work with the Somali Livestock Production Specialist in each production system.

28. Sample Herds. A major part of the livestock production and health activity within SIMP would revolve around the study of fifteen pastoral households and their associated herds in each production system. Allowing for attrition, it is hoped that at least ten could be continually studied during the one year SIMP period, plus at least the next year which would be devoted to the pre-development survey. When possible, a sample stratified according to wealth; 5 wealthy, 5 normal and 5 poor households, would be chosen.

29. In production systems which contain controlled (deferred) grazing reserves, the sample herds would be chosen so that same numbers are within the reserve and outside. This would help evaluate the effects of introduced grazing systems. Each herd would be visited monthly by SIMP staff.

30. Camels are difficult to study properly under local nomadic conditions. Therefore, they are not well understood, despite having a critical role in pastoral production systems. To ensure close study, a herd of 30 camels would be purchased and loaned to suitable young pastoralists on a contractual agreement basis. They would manage the herd and co-operate with interventions and studies in return for the use of the camels, their milk, and part of their progeny. A high producing bull camel would be purchased and a small-scale breeding programme begun.

31. Herd Dynamics would be studied for all herds, using the rapid herd appraisal type techniques developed by ILCA. The following attributes would be measured every month and the results analysed: number and type of herd increases, off-take and losses, purchases, births, gifts, loans, eaten, and killed. Age, sex, weight and herd structure would also be recorded.

Pastoral Production

32. Pastoral production would be studied and the price of livestock transactions recorded. The milk production of a small, but adequate, sample of lactating camels, goats and cows would be measured by repeated daily milking every two months. Milk consumption by young animals and people would be estimated by adapting the local teat tying technique. The quantity of milk sold or made into ghee would also be recorded as part of an investigation into local pastoral milk production, use, and household subsistence strategy. Attention would be given to determining the quantity and period of any excess milk

production. The quantity, treatment, destination and value of all livestock hides and skins would also be recorded over time for some of the study households.

Pastoral Husbandry

33. A study of pastoral husbandry would not only involve some of the 15 sample households/herds in each production system, but also utilise data collected by SRF and SRRF on number, type and distribution of livestock. Seasonal movements of stock would come from the SRF component. The rationale for these movements would be further investigated by livestock/socio-economic teams on the ground.

34. In addition, an intensive detailed understanding of herd management would be sought by livestock husbandry and socio-economic staff accompanying a sample of the most co-operative of the 15 sample households/herds. This would be done for a few days at a time, three times each season (12 times a year). A female Extensionist or Socio-Economist would be part of the team to facilitate communications with female members and help collect household economic data.

35. Through observation and discussion, the team would investigate in detail the daily and seasonal pastoral management systems including decision-making (where to herd, what to sell, etc.), herding strategies, commercial production, breeding strategies, breeding and sire/dam selection techniques, control of mating and mating time, management strategies for young livestock (including exclusion of colostrum, fostering, killing young), culling strategies, milk production strategies, livestock watering system (including quantity of water used), yarding of herds at night, and rationale for movement patterns of herds, etc. Other areas of investigation would include:-

- (a) General day-to-day and seasonal herding management including where, why and how all four species of livestock are grazed.
- (b) The extent of free range grazing, the trends and the rationale involved.
- (c) General livestock watering patterns.
- (d) Production constraints identified by pastoralists and their suggestions for increasing sustainable production.
- (e) Local off-take and marketing systems, pastoral off-take, selling strategies and trends.
- (f) General production, use, treatment and sale of milk and other livestock products.
- (g) General breeding, selection and culling strategies used locally.
- (h) Pastoralists' methods of describing and classifying livestock.
- (i) Methods of rearing young stock.
- (j) Methods of, and rationale behind, division of stock for grazing or other reasons.
- (k) Selection of stock for sale, purchase, exchange, or gift.
- (l) Killing of young livestock as a management practice, and potential use of this technique with camels, etc., to indicate impending droughts.

All these investigations would aim to identify constraints and means for increasing sustainable production, while ensuring the conservation of natural resources.

Agro-Pastoralism

36. This activity within SIMP would be directed by the Head of the Agro-pastoral Section who would train, and be assisted by, counterpart Somali Agro-pastoral Officers.

37. The objectives of this activity would be to:-

- (a) Determine the area, type and production of crops grown each season.
- ✓(b) In co-operation with the Range Manager and Remote Sensing/Monitoring Unit, develop a rapid method for measuring the stage of land use of agro-pastoral land, including currently cropped, fallowed for 1-2 years, fallowed 2-5 years, 5-20 years and over 20-30 years, and to use this technique to determine the type and trend in land use from sequential aerial photographs, satellite images and aerial observations.
- ✓(c) Determine the quantity and quality of forage, pasture and crop residues produced under cropping and various stages of fallow and virgin land, both under communal range management and inside the private enclosures.
- (d) Identify innovative agro-pastoralists and study the potential usefulness of their innovative practices including the reseedling of fallow areas, live fencing, anti-erosion agronomic techniques, and alternative uses of local plants.
- (e) Identify knowledgeable, reliable agro-pastoralists; work with the Socio-Economist to determine the history of agro-pastoralism in the area; and relate this to local land/soil classification systems, degraded areas, local water development and other significant factors.
- (f) Carry out an extensive, generalised characterisation of the agro-pastoral soil types, and relate these to the local land/soil classification schemes and the range sites identified by the Ecologists.
- ✓(g) Undertake an analysis of the nutrient status of the soils and crops during the cropping cycle, and the recovery of the soils during the fallowing cycle. Co-operate with the Range Manager in determining how the nature of vegetative regrowth (secondary succession) can be used as a quick and reliable indication of soil fertility.
- (h) Determine the basic subsistence and commercial agro-pastoral production strategies and identify constraints, problems and potential interventions, using the site case study technique.

Pre-Development Survey

38. Pre-development surveys would be the second stage of development to be carried out by CRDP-II. Their purpose would be to extend the practical development-related findings of the SIMP team, based on a relatively small part of a production system, throughout the remainder of the production system. For instance, a major finding of the SIMP phase might be that under-utilisation of forage over large areas, due to lack of dry season water sources, was a major constraint to realising the productive potential of a production system. The pre-development survey would then place emphasis on locating similar areas throughout the rest of the production system; determine the most applicable type of source (borehole, shallow well, dugout, diesel pump, windmill, etc.) and lay the groundwork for public acceptance and participation in location, use and maintenance, where necessary. Surveys and studies not completed during SIMP phase would be continued and completed. Pre-development surveys would be carried out on a district-by-district basis by four district-based professional

staff; the District Range Officer and three District Extension Officers. They would have been recently appointed to these positions, having been previously trained in survey techniques, including use of aerial reconnaissance flight data and other inputs from the Remote Sensing Unit, whilst members of the SIMP team within the production system concerned. Expatriate SIMP team experts would return periodically to assist district staff in carrying out the pre-development survey. Because district boundaries do not coincide with production system boundaries, pre-development surveys would be carried out only within that part of the district which lies within a studied production system.

39. An aspect of the agro-pastoral activity in the redevelopment surveys is the need to undertake case studies of agro-pastoral units outside the previous SIMP study areas to check for variation in, for instance, agronomic practices. Potential co-operative demonstration agro-pastoralists would be identified. The needs and priorities of local inhabitants would be determined. A pre-development type activity which, however, does not fit within the carefully phased approach of sequential work in individual districts, is the need to identify those areas within the Central Rangelands which are far from water and which have relatively large reserves of fodder. This must be done early in the project so that, should drought suddenly occur, plans could quickly be carried out to place new boreholes in these areas to reduce livestock losses.

Management Plans

40. The preparation of management plans would follow and be based on the pre-development survey of each district. Management plan preparation would be a team effort by district staff with local elders, RLA committees and district Government officers, under the specific direction of the District Range Officer.

41. Management plans would be prepared for individual degaans for which RLAs were to be organised. Because district boundaries do not usually coincide with those of production systems, management plans would be prepared only for those degaans which lie within a studied production system. Management plans would be simple so as to be easily understood. They would include the type, place, timing and reason for each management intervention, as well as the type of maintenance activity needed, how this would be carried out and by whom. These arrangements would be important.

Remote Sensing and Monitoring

42. Remote sensing is a technique (or family of techniques) used to carry out surveys over large areas. As such, it is directly applicable to use within the Central Rangelands. The nature of the attributes which can adequately be sensed depends upon the specific technique and scale used but, in general, the larger the area to be surveyed the smaller the scale used and the more generalised the attribute sensed. Remote sensing of rangeland production system attributes can be carried out using satellite imagery, aerial photography or light aircraft. It is often a means of facilitating ecological monitoring. Monitoring refers to the method of resampling attributes sequentially through time. This is done to determine if the attribute in question shows a trend (change through time) in quantity, quality or position/location. Trends in production system attributes may have significant management implications. Examples might be the increase over a number of years in livestock numbers or an increase in area of land cleared for farming. Other trends may result from management interventions. These are equally significant because they reflect the relative success of the intervention concerned. An example might be the yearly increase in vegetative cover on grazing reserves. Another might be the provision of insight into otherwise unthought of aspects of the intervention, such as an increase in

settlement and fenced enclosures around a new borehole, which significantly reduce the extent to which the area surrounding the borehole can be used by pastoralists. Therefore, monitoring is a particularly important activity within CRDP-II.

Remote Sensing Unit

43. A Remote Sensing Unit (RSU) would be organised to take responsibility for all remote sensing activities within the Central Rangelands. Ultimately, it would also take over responsibility for all ecological monitoring activities as well, except for the actual collection of field data which would continue to be the responsibility of permanent district staff.

44. Under the immediate supervision of the Development Systems Analyst, the RSU would carry out the following activities:-

- (a) Interpretation of sequential stages of LANDSAT satellite and aerial photo coverage of the entire Central Rangelands. This would describe the existing situation as well as past and present trends in small-scale attributes, such as location, area, pattern and direction of movement of large sand dunes and dune fields, cultivated and fallow land, and areas of extreme soil erosion. Use of existing aerial photography would allow past trends to be determined from the 1960s.
- (b) Larger-scale aerial photography of smaller, specially selected areas would be used to survey more detailed attributes. An example is the use of 1:20,000 b/w aerial photography already available to describe the agro-pastoral production systems within Ceel Dheer district. This would be done in terms of, where applicable, number, area, location/spatial patterns of farms, different stages of regrowth, uncleared land, fenced enclosures, and different type of water points, villages, and houses within villages.
- (c) Analysis of NOAA satellite imagery obtained twice a month to help develop a drought/famine early warning system for the Central Rangelands. "Normal" spatial and temporal patterns would be developed for vegetation activity, the raw data for which would be taken directly from each satellite image in terms of the NDVI vegetation activity index. Significant deviations from these "normal" patterns may indicate possible developing drought/famine.
- (d) Placement, maintenance and analysis of data from a meteorological recording system covering the whole of the Central Rangelands. This system would be constituted primarily by a number of automatic meteorological recording stations, although other manual instruments may also be used where necessary. An automatic meteorological recording station would be placed within each district at the site of the district CRDP headquarters. In addition, three stations would be placed at other sites where they would be adequately guarded and maintained, and where they would provide especially useful information. These stations would automatically record a wide range of meteorological characteristics such as rainfall timing, amount and intensity, as well as others which would be used to develop indices of potential evaporation. Data would be recorded on tapes/modules which would be brought to Mogadishu monthly and processed by computer. Meteorological instrumentation would be compatible with the other automatic meteorological recording systems in Somalia to provide comparability of data over wide areas.

- (e) Receive all ecological, sociological and economic monitoring data from the district staff who collect it in the field, and develop a computerised database. The database would include data from satellite and aerial photo imagery, SRF and SRRF aerial census, meteorological recording stations, range trend monitoring plots, representative households and herds, and from the monitoring of specific management interventions.
- (f) Carry out all necessary analyses. This would include the identification of trends, the refinement of working models for each production system and the development of a drought/famine early warning system using special sensitive indices of various types.
- (g) In co-operation with other staff members, identify constraints to production and develop management interventions to overcome these constraints.
- (h) Increasingly during phase II, as the activities of the SIMP team move on to other production systems and districts, take over the supervision of field collection of monitoring data. This would require increased contact between the RSU and district field staff who would continue to do the actual data collection.

45. In order to maintain a high degree of efficiency in field collection of monitoring data, the RSU must ensure that the district staff remain interested in the monitoring programme and are aware of its importance and the need for systematised and precise measurements. The RSU would do this by, among other things, organising periodic workshops for district staff on sampling and measuring techniques and the results of monitoring work to-date. Frequent visits would be made to districts to work with district staff in routine data collection activities.

46. By the end of phase II, the RSU would be fully staffed and trained to the point where it can continue to monitor ecological, sociological and economic trends and operate a drought/famine early warning system throughout the entire CRDP on a routine long-term basis. It should also then be able, given the need, to extend its remote sensing activities over a much wider area of Somalia.

47. The RSU would be under the direct supervision of the Development Systems Analyst. He would work with a Somali Senior Remote Sensing/Monitoring Officer. There would also be one Computer Operator and two Photogrammetrists/Interpreters. In year 3, two additional Somali staff would be hired to organise workshops and to maintain contact in the field with district staff. The SRF and SRRF staff would also be part of the RSU.

48. The establishment of the monitoring system in the field (plots, herds, households, etc.) would be carried out by the SIMP team and subsequently, where necessary, by the permanent district staff. The latter would also be responsible for routine data collection in the field. They would be assisted in this during the early stages of work in each production system by the SIMP team expatriate experts. During the latter stages of work in each production system, the RSU would take over more and more responsibility for co-ordinating and expediting the collection of monitoring data in the field.

C. PHASING OF SIMP PRE-DEVELOPMENT SURVEYS, INTERVENTIONS AND MONITORING (Refer Figs. A1.1 and A1.2)

Year 1

49. Beginning of Long-Term Monitoring Programme. The long-term monitoring programme would start with a SRRF survey over the entire Central Rangelands in

FIGURE A1.1 : PRODUCTION SYSTEMS

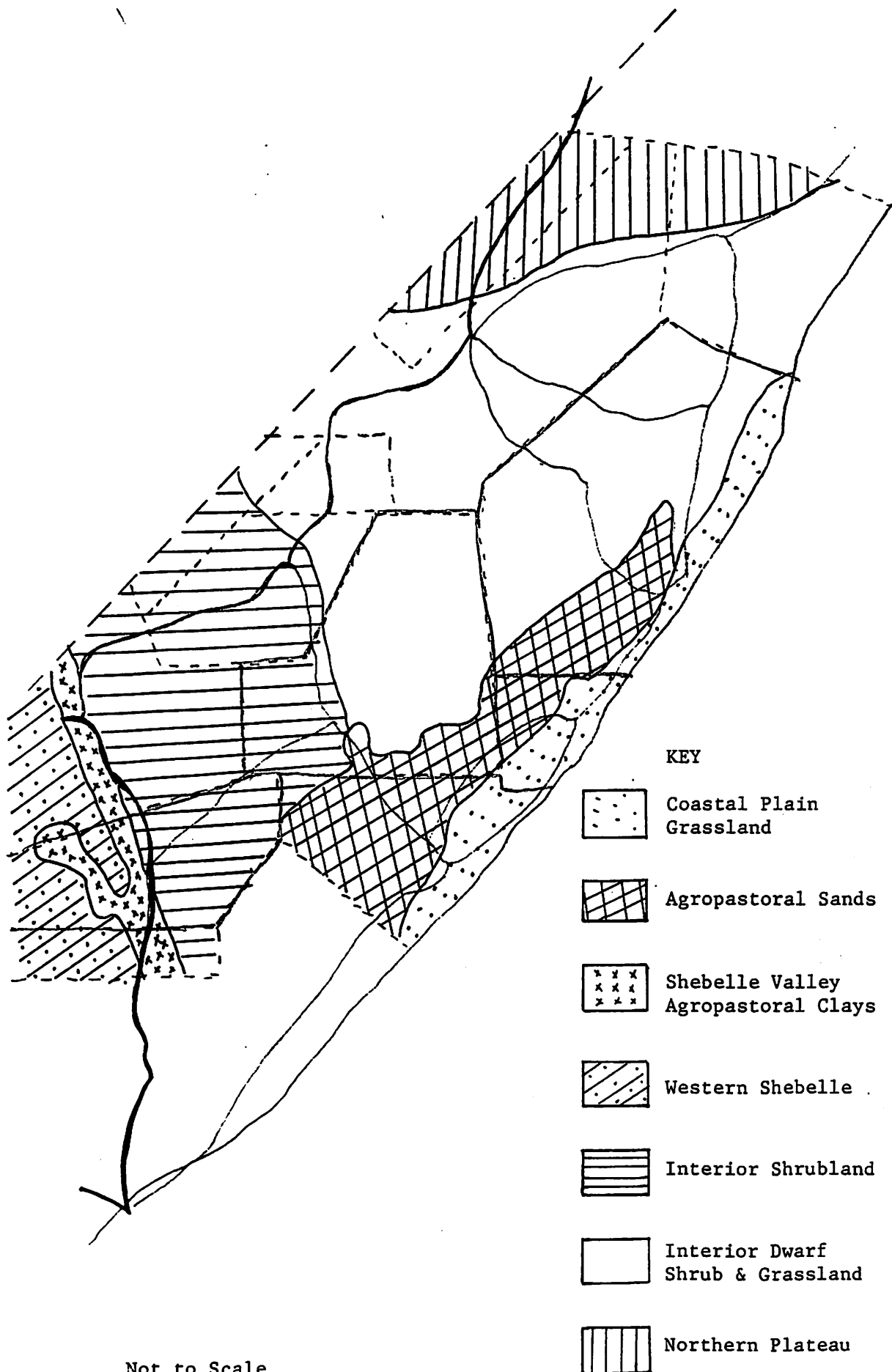
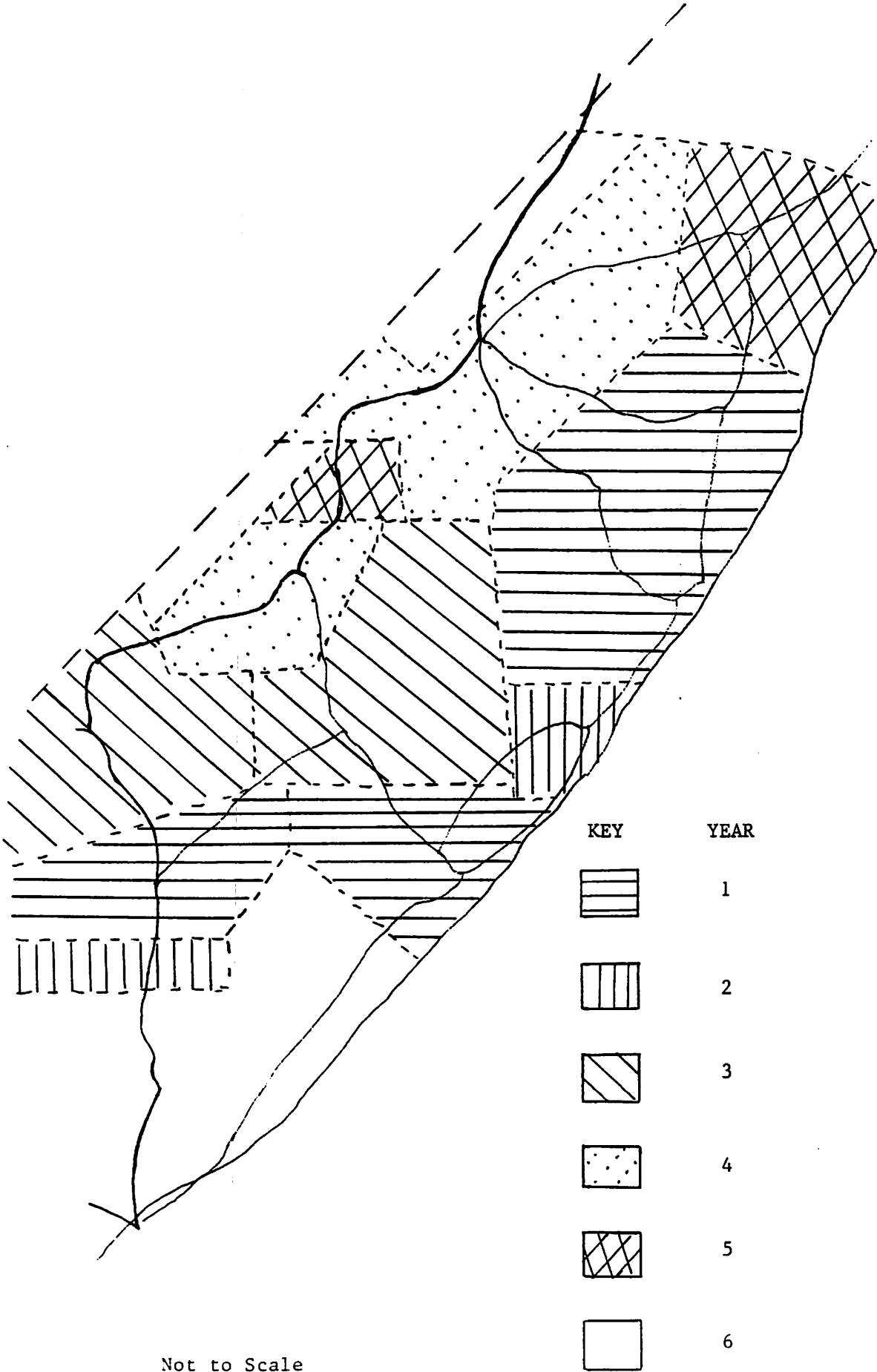


FIGURE A1.2 : SCHEMATIC REPRESENTATION OF TIMING OF
PREDEVELOPMENT PROGRAMMES BY DISTRICTS



Not to Scale

the first wet season of year one. At the same time, recent LANDSAT satellite images would be analysed. The purpose would be to identify the major types and sub-types of production systems comprising the Central Rangelands; map and provide a brief characterisation of their major features, such as location, area, major land use(s); and determine the types, numbers and seasonal distribution of livestock, etc. Trends in small-scale patterns of land use over the past 10-30 years would also be obtained by comparison with older sets of images, aerial photographs, plus the 1979 RMR survey. The SRRF flights would be repeated periodically over the Central Rangelands throughout the life of the project - as would the satellite coverages. Therefore, this stage, which could be termed a reconnaissance stage, would be the beginning of the long-term monitoring activity. The long-term monitoring programme established under USAID funding would be continued following termination of USAID phase I by CRDP-II. SRF flights would be carried out seasonally over selected representative areas of each production system.

50. SIMP Programme Production Systems 1 and 2. The SIMP team would carry out integrated surveys and studies and set-up a monitoring base within the first two production systems. These would complement phase I activities by concentrating on agro-pastoral systems about which little is yet known, and on livestock and socio-economics which were inadequately studied during phase I. Counterpart officers would continue monitoring activities at the district level. This particular set of counterpart officers would be trained to complement district staff already in place within the three original priority districts.

Year 2

51. SIMP Programme Production Systems 3 and 4. The SIMP team would operate within production systems 3 and 4. SIMP SRF flights would continue seasonally over those areas selected as representative of the major production systems. The team would periodically visit counterparts in districts 1-3 to continue training.

52. Pre-Development Surveys would be carried out by counterpart staff in the first three districts. Emphasis would be placed on the agro-pastoral system as this system is least well known, has the greatest potential, and requires more effort than pastoral systems within these districts which are relatively well known because of the phase I activities.

53. Management Interventions. Where feasible, proven, initial, environmentally safe management interventions with a high public relations profile would be started within districts 4 and 5. Because of past phase I activities within the pastoral production systems in these districts, these interventions would probably be within the agro-pastoral system.

54. Monitoring. Long and medium-term monitoring would be a wholly phase II activity (the USAID-funded phase I would have been completed). Long-term and medium-term monitoring would be continued by the RSU. Most of the management intervention monitoring would still be for the first three districts only. However, by year 2 it would include all the production systems within these districts.

Year 3

55. SIMP Programme Production Systems 5 and 6. The SIMP team would carry out integrated surveys of production systems 5 and 6. SIMP SRF flights would be continued seasonally over the sample area and would be representative of major production systems. SIMP team expatriates would periodically visit counterparts in districts 1-5 to assist, check and train.

56. Pre-Development Surveys would be carried out within an additional two districts (4 and 5). Work would be restricted, where necessary, to those parts of the districts within production systems already studied. As in the case of the year before, emphasis would be placed on agro-pastoral systems because much of the survey work within the pastoral production systems of these two districts would already have been completed by CRDP-I.

57. Management Interventions. The initial management interventions begun within the first three districts would be completed. If required, management interventions, based on the results of previous SIMP studies and pre-development surveys, would be initiated within districts 4 and 5. A few initial, proven, ecologically safe and high profile interventions would be carried out in the new pair of districts (numbers 6 and 7) at the same time as the SIMP activities are being carried out.

58. Monitoring. The basis for monitoring management interventions would be established within districts 1-3. Long and medium-term monitoring would be continued by the Remote Sensing and Monitoring Unit. Range trend plots and subject household and livestock herds would be established district-by-district as field work progressed.

59. A second SRRF aerial census would be conducted over the entire Central Rangelands.

Year 4

60. SIMP Programme Production System 7. The SIMP team would operate within production system 7. SIMP SRF aerial census would continue seasonally over the sample areas representative of the major production systems. SIMP team expatriates would periodically visit districts 4-7 to assist, check and train counterparts. They would visit districts 1-3 less often as there would be less need.

61. Pre-Development Surveys would be carried out within two additional districts, numbers 6 and 7. As only one of these districts would have had any previous phase I activities, surveys would be more comprehensive than in the other districts.

62. Management Interventions. Some initial interventions which are simple, proven, environmentally safe and have high profiles may be begun at the same time as SIMP activities within districts 8 and 9. Management interventions initiated in previous districts would be either completed or continued. Where necessary, others would be started.

63. Monitoring. All routine monitoring activities would be continued. Data from monitoring units established in the last pair of districts would be added to the baseline data storage system. In about year 4, the monitoring unit would commence to oversee and co-ordinate the continued collection of all ecological monitoring data by district staff in districts 1-3. The unit would be responsible for data analysis and interpretation at headquarters.

Year 5

64. SIMP Programme. The SIMP team would assist in starting pre-development in two districts, numbers 8 and 9, and periodically visit staff in previous districts to assist and train in all subsequent activities. Seasonal SRF flights would continue on representative areas of major production systems.

65. Pre-Development Surveys would be carried out within districts 8 and 9.

66. Management Interventions. A few simple, proven, environmentally safe and high profile management interventions would be initiated in two new districts, numbers 10 and 11, pending completion of planned pre-development surveys. Interventions in all previous districts would be completed or continued and, where needed, others began.

67. Monitoring. Long and medium-term monitoring activities would continue, as would monitoring of management interventions in all districts in which they occur. A third Central Rangelands-wide SRRF aerial census would be carried out. The RSU would take over responsibility for overseeing and co-ordinating collection of ecological monitoring data (by district staff) in districts 4 and 5.

Year 6

68. SIMP Programme. The SIMP expatriate team would continue assisting with development and monitoring activities wherever required.

69. Pre-Development Surveys would be carried out within districts 10 and 11.

70. Management Interventions. A few simple, proven and environmentally safe management interventions would be initiated in districts 12 and 13, pending completion of pre-development surveys. Management intervention in all previous districts would be completed or continued and others begun where needed.

71. Monitoring. Long and medium-term monitoring and monitoring of management interventions would continue. The RSU would take over responsibility for overseeing and co-ordinating collection of ecological monitoring data (by district staff) in districts 6 and 7.

D. RANGE MANAGEMENT AND SOIL AND WATER CONSERVATION

General Discussion

72. Range activities are discussed in this section because, within the context of phase II, much of the range-related effort would focus on the provision of baseline data on soils, vegetation, vegetation responses to livestock and human activities in the project area. These baseline data are essential if correct management decisions are to be made on range development, soil and water conservation, agro-pastoralism, water development and livestock production, i.e. all the major fields of activity in CRDP-II. The rangeland resource database would not only be of immediate and direct value for decisions on management interventions, but also as a long-term base which can be added to periodically, thereby allowing trends in important production system attributes to be monitored.

73. Range inventory, which includes range site descriptions, range condition classification, description of forage quality, production, and responses to human and livestock use, would be an integral part of SIMP and subsequent pre-development surveys. The inventory would make considerable use of, as well as provide necessary ground control data, for systematic reconnaissance flights and other remote sensing methodologies.

74. The preparation of management plans would follow and be based on the pre-development surveys of each district. Management plan preparation would be a team effort by district staff with local elders, RLA committees and District Government officers under the close direction of the District Range Officers, assisted by other SIMP personnel.

75. Management plans would be prepared for individual degaans for which RLAs were to be organised. Because district boundaries do not usually coincide with those of production systems, management plans would be prepared only for those degaans which lie within a studied production system. Management plans would be simple so they can be easily understood. They would include the type, place, timing and reason for each management intervention, as well as the type of maintenance activity needed, and the mechanism for maintenance activities. These arrangements would be important.

76. The principal range management interventions would be controlled grazing reserves and pasture rehabilitation. Both require some form of grazing control. CRDP-I established seven deferred (controlled) grazing reserves (Hobbio District 2, Ceel Dheer District 2, and Bula Burti District 3). The reserves in Hobbio and Ceel Dheer Districts occur on coastal plain grassland which supports primarily sheep and goats. Those in Bula Burti District are in shrubland and support mainly goats and camels. The principal objective of all the deferred grazing reserves is to upgrade the condition of degraded rangeland. On the coastal plain this would be achieved by increasing vegetative cover and plant vigour and by changing the ratio of high and low quality forage species in favour of the former. In the Bula Burti shrublands, the vigour, abundance and distribution of the shrub Comdesuxis would be increased to its original status.

77. Several areas have been identified within the Central Rangelands which, because of highly eroded and often surface compacted soils caused by long-term over-use by livestock, require special pasture rehabilitation measures. An experimental pasture pitting trial has been established on these soils near the town of Ceel Buur. Several promising range forage species were planted/sown in this trial using different methods of pasture pitting. A new pasture pitter would be purchased by CRDP-II to expedite the planned pasture rehabilitation activities.

78. Visible, measurable results from deferred grazing reserves and pasture pitted areas are slow to occur and, generally, not of high potential. This is because of the inherently low and variable rainfall, which limits potential productivity, and the slowness with which local pastoralists accept and understand the usefulness of these activities. This is particularly the case for controlled grazing reserves.

79. Nevertheless, they remain necessary interventions in the rehabilitation of degraded rangelands, and their effectiveness in this regard has been demonstrated by the two oldest reserves in Hobbio district. CRDP-II would continue to support the existing reserves and would site additional reserves wherever circumstances require and allow. However, emphasis would be placed on the "pilot" nature of grazing reserves. For this reason, they would be few in number, closely monitored to determine their technological effectiveness, and used to their fullest as demonstrations of the utility of this approach to local pastoralists. This would require a great deal of time and effort by project staff.

Planned Activities

80. The major effect in management interventions would be in village-related activities. These would likely include the following, although details would be dependent on the findings of the pre-development surveys; village conservation areas, nurseries, shelterbelts, and in a small number of cases, stabilisation of small sand dunes. The major objective would be to conserve existing natural resources and to improve the quality of life for the village inhabitants.

81. Village conservation areas would be made by fencing and protecting from use, degraded rangeland in the immediate vicinities of villages. These seldom exceed a few square kilometres in area. Because the vicinities of villages are usually the most degraded areas of rangeland, they often contain relatively small sand dunes. Where possible, these would be both fenced and planted to encourage stabilisation.

82. Some scattered isolated dunes occur away from villages. Where these are small enough to stabilise and are threatening local cultivation, roads, wells, etc., they would be stabilised. Live fences of Commiphora spp. would be used to ensure permanency and reduce the need to cut more trees in the future to replace old or decayed fences and the interior plantings.

83. About three village shelterbelts and one nursery would be required per district. Some districts already have nurseries. Seedlings for planting in village shelterbelts would be grown in district nurseries. Where available, shelterbelts would be an integral part of village conservation areas and fencing would be provided for protection of the shelterbelts. Where conservation areas do not exist, fencing would be provided for the shelterbelts. The nurseries would also provide seedlings for private plantings within the villages and seedlings of both woody and herbaceous species for agro-forestry trials.

84. A few interventions would be carried out with the principle objective of both conserving existing resources while maintaining productivity. Examples are controlled grazing reserves and pasture rehabilitation areas which would be carried out on a trial basis to investigate if forage resources can be kept from further degradation. The potential for increased productivity would be low. CRDP-II would create up to three grazing reserves and perhaps four pasture rehabilitation areas.

85. Possibilities for development of limited high watertable areas are discussed in Annex 3.

Implementation

86. The village-related management interventions which would be carried out to conserve existing resources and improve the quality of life would be implemented early in the project life in any district, and would not require a great amount of planning. Their need would be apparent, a local consensus would normally be quickly obtained before their implementation; the sites would be small with easy access and the logistical requirements would be minimal. A limited number of such interventions would be started in a district during the pre-development survey stage. As they would be highly visible, they would increase the local credibility of CRDP and help future development activities.

87. Management interventions would not be implemented until complete agreement was reached with the local RLA committee and District Government as to their desirability, location, size and means of maintenance. To the extent possible, local groups would agree to maintain, guard and take part in management interventions before they were implemented. Implementation would be considered as a long-term process. It would continue within any one district, probably throughout CRDP-II.

88. A system of automatic meteorological stations and rain gauges would be established during SIMP activities. These would provide an important aspect of the long-term monitoring progress for CRDP-II. Range management and soil and water conservation personnel would also begin to establish permanent sample plots for the measurement of range trends and would complete this activity following the initiation of management interventions. They would also

23

establish, in association with the remote sensing unit, plots to monitor the trend/success of specific management interventions. Examples might be the relative success of tree species planted in shelterbelts or the degree to which range condition is improved by a grazing reserve.

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

EXTENSION

EXTENSIONTABLE OF CONTENTS

	<u>Page</u>
A. INTRODUCTION AND BACKGROUND	1
B. OBJECTIVES	1
C. GENERAL ORGANISATION AND STAFFING	2
D. EXTENSION METHODOLOGY	7
Investigation, Training, Demonstration and Visit System	7
Investigation	7
Training	8
Demonstrations	9
Proven Technology Ready for Demonstration and Transfer	9
Technology Partially Ready for Demonstration and Transfer	10
Potential Technology for Evaluation and Demonstration	11
Visits/Meetings	12
Communication and Education Aids	13
Audiovisual Aid Production and Use	13
Radio and Mass Media	14
E. LINKAGE WITH RESEARCH AND OTHER ORGANISATIONS	14
F. USE OF COMMUNITY GROUPS	15
Range and Livestock Associations	15
Village and District Communities	17
G. RURAL DEVELOPMENT AND ENTERPRISE DIVERSIFICATION	17
Identification of Appropriate Enterprises	18
Rural Community Development Enterprises	18
Direct Project Supported Community Ventures	18
Indirect Project Supported Community Ventures	20
H. DIRECT SUPPORT FOR PRIVATE ENTERPRISE	20
I. INDIRECT SUPPORT FOR PRIVATE ENTERPRISE	20
J. LINKAGES WITH OTHER ORGANISATIONS	20

EXTENSION

A. INTRODUCTION AND BACKGROUND

1. CRDP-I included a non-formal education and training (NFET) component. The principal objective of this component was to establish and maintain effective communication between the nomadic and semi-nomadic pastoral peoples of Central Somalia, with the project. The communication aspect of extension was emphasised rather than technology transfer or the supply of inputs and services. This was because the first phase was a pilot project, as range development work had not preceded the project to develop and evaluate appropriate technology. The NFET component proved to be a vital aspect of development during the first phase. It established an effective dialogue between the pastoral inhabitants and the project, so that the target population increasingly participated in, and contributed to, the planning and implementation of development activities. A core of trained and experienced NFET staff was established which, as the project progressed, became an information source and contact people for all project activities. Of greatest importance was the fostering of a good relationship, ready exchange of information and opinions, and co-operation between the project staff, the target population and local Government officials. The extension staff were both helped and hindered in this activity by the lack of previous development projects in the area.

2. The NFET component, for the first time in Somalia, established a systematic, informed, ordered and sequential procedure for forming and establishing Range and Livestock Associations (RLAs) and for selecting sites for water bores and dugouts. Water developments are very sensitive and potentially destructive, so an innovative structured procedure was developed. It took into account local social, political, ecological, range management, animal husbandry and hydrological factors, in an integrated manner.

3. The component also established an audiovisual aid support unit, with the ability to produce extension and training literature, visual aids, radio programmes, video films and audio slide shows.

4. The first phase established a good basis on which to develop a capable and effective Extension Section within the National Range Agency (NRA). The long-term impact of CRDP-II would largely depend on the success of the Extension Section. The information and technology gathered by the project's studies and adaptive trials must be transferred to the pastoralists and agro-pastoralists, and local institutions need to be involved in the development of a capacity to institute, manage, and maintain community-level development activities.

B. OBJECTIVES

5. The main objective would be to develop a well trained, highly motivated, professional and efficient extension service which would:-

- (a) Through non-formal education and training, maintain an effective dialogue and two-way educational process between the target population and the project. By these means, the extension staff would develop mutual understanding, respect and co-operation.
- (b) Through the extension processes, develop the local understanding, ability, institutions and enterprises necessary to attain the general project objectives.

- (c) Evaluate technology for local acceptability and ability to meet project objectives and then transfer it through the extension processes so that it has the maximum positive impact.

C. GENERAL ORGANISATION AND STAFFING

6. The Extension Section would be organised on a vertical hierarchical structure, refer Figures A2.1 to A2.4. The Extension Resources Support Group under the Senior Communications Officer (publications, mobile films, audiovisual and radio/mass media); the Subject Matter Specialist/Training Group and the Rural Development Group would all be based at headquarters and responsible to the Head of Extension Services who would report to the Chief Extension Officer and in turn the Head of Field Services 1/. These senior staff would provide overall technical direction, supervision and training, and ensure that the district extension staff are provided with adequate and appropriate training, technical advice, audiovisual aids and specialised extension support. The support groups would assist the staff in the Field Services Division and the District Range Officers (DROs) to plan and technically supervise the field staff (District Extension Officers (DEOs) and Village Extension Workers (VEWs)). Specifically, the SMSs would be responsible for the quality control aspect of the extension programme. Each month, during their regular visits, they would review the district extension programmes and advise the DROs on improvements.

7. At the district level, the three DEOs in each district would be responsible to the DRO. Each DEO would be assigned responsibility for project development activities in one-third of a district. The districts are divided administratively and traditionally into grazing "degaans". There are between six to 13 degaans per district, so one DEO would be assigned two to five degaans, depending on the district in which he would be working.

8. At the degaan level, one VEW would be given responsibility for all project development activities within one degaan. Each DEO would train and supervise between two to five VEWs.

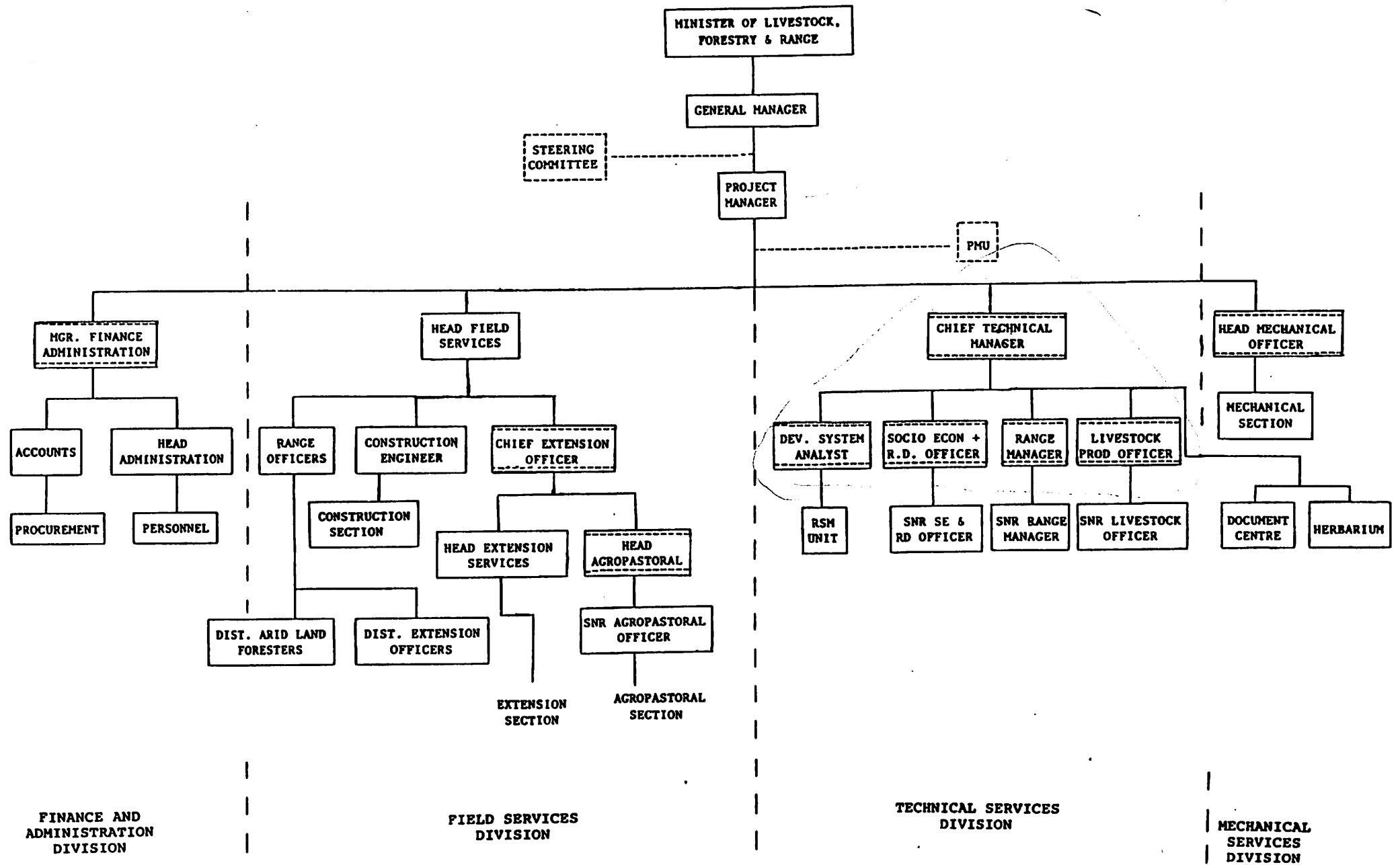
9. The DEOs would be graduates with two years post-graduate multidisciplinary experience working in the SIMP 2/ teams. This would be a crucial aspect of the project, as the DEOs need to be capable, well trained generalists, to be able to undertake demanding multidisciplinary duties. The VEWs would be young local people carefully selected from the areas in which they would work. They would be employed on a monthly basis by their DEO, and work under the administrative supervision of the DRO. The VEWs would be young, active and motivated people, committed to developing their communities. They would have few other responsibilities or commercial interests, so they could devote their full attention and time to the job. They would therefore not be Range Elders, as employed in the first phase, who were old and influential local leaders. The Elders have many other responsibilities and commitments, so cannot be employed as VEWs. The VEWs would be selected by the DEOs, the local RLAs and village committees, in consultation with the DRO and local authorities.

10. The VEWs would follow a systematic and regular monthly work programme. They would be supervised frequently by the DEOs and checked monthly by the SMSs and DRO. The DEOs would also work to a regular monthly programme, so local pastoralists know where and when they could be contacted.

1/ Annex 3 outlines the hierarchy of the Agro-Pastoral Section which would also report to the Head of Field Services.

2/ SIMP; Systems Investigation and Monitoring Programme, refer Annex 1.

FIGURE A 2.1 : CENTRAL RANGELANDS DEVELOPMENT PROJECT PHASE-II PROPOSED ORGANISATION



KEY

EXPATRIATE

FIGURE A 2.2 : CENTRAL RANGELANDS DEVELOPMENT PROJECT PHASE-II PROPOSED ORGANISATION - FIELD SERVICES

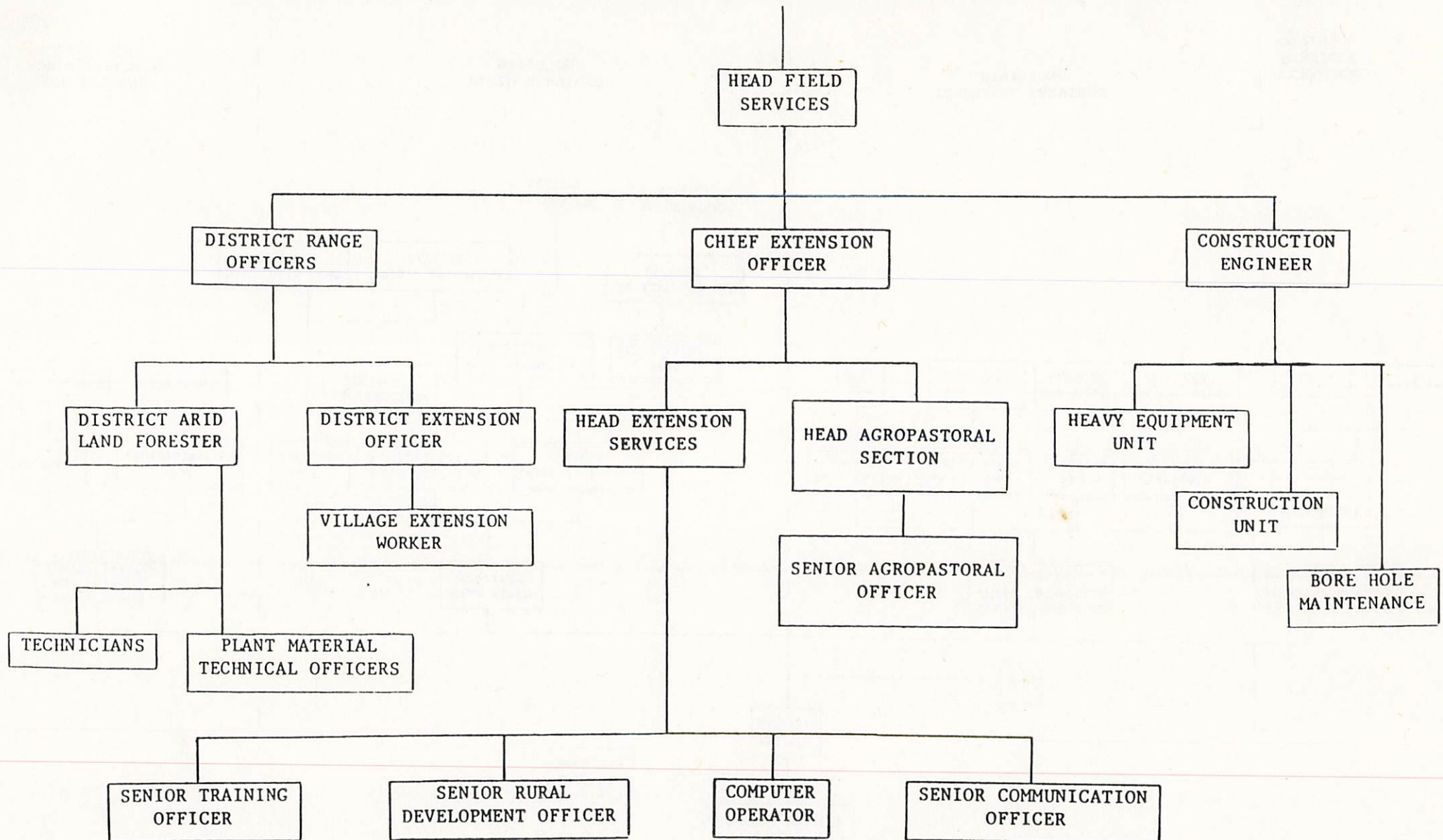


FIGURE A 2.3: CENTRAL RANGELANDS DEVELOPMENT PROJECT PHASE-II PROPOSED ORGANISATION - AGROPASTORAL SECTION

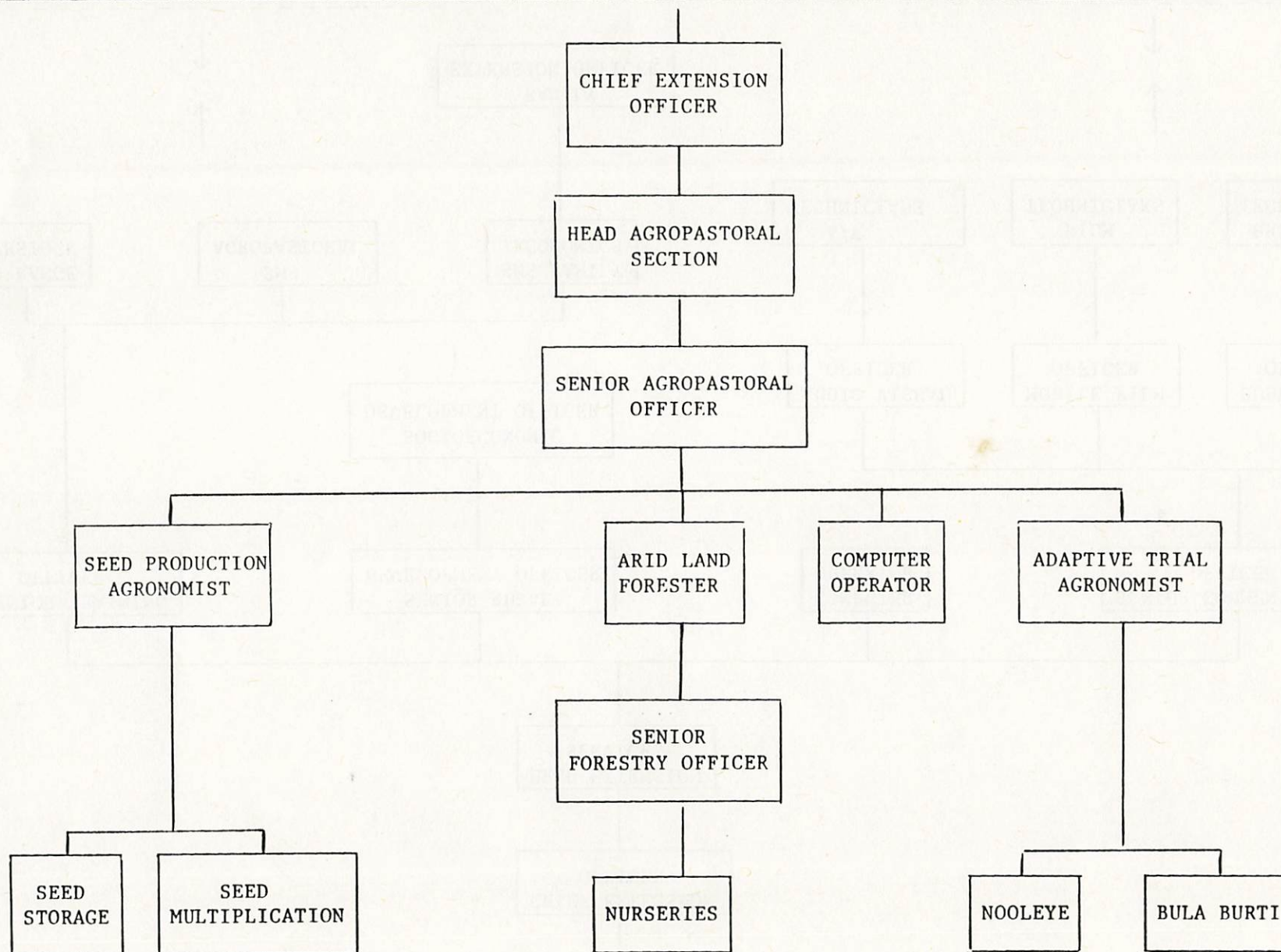
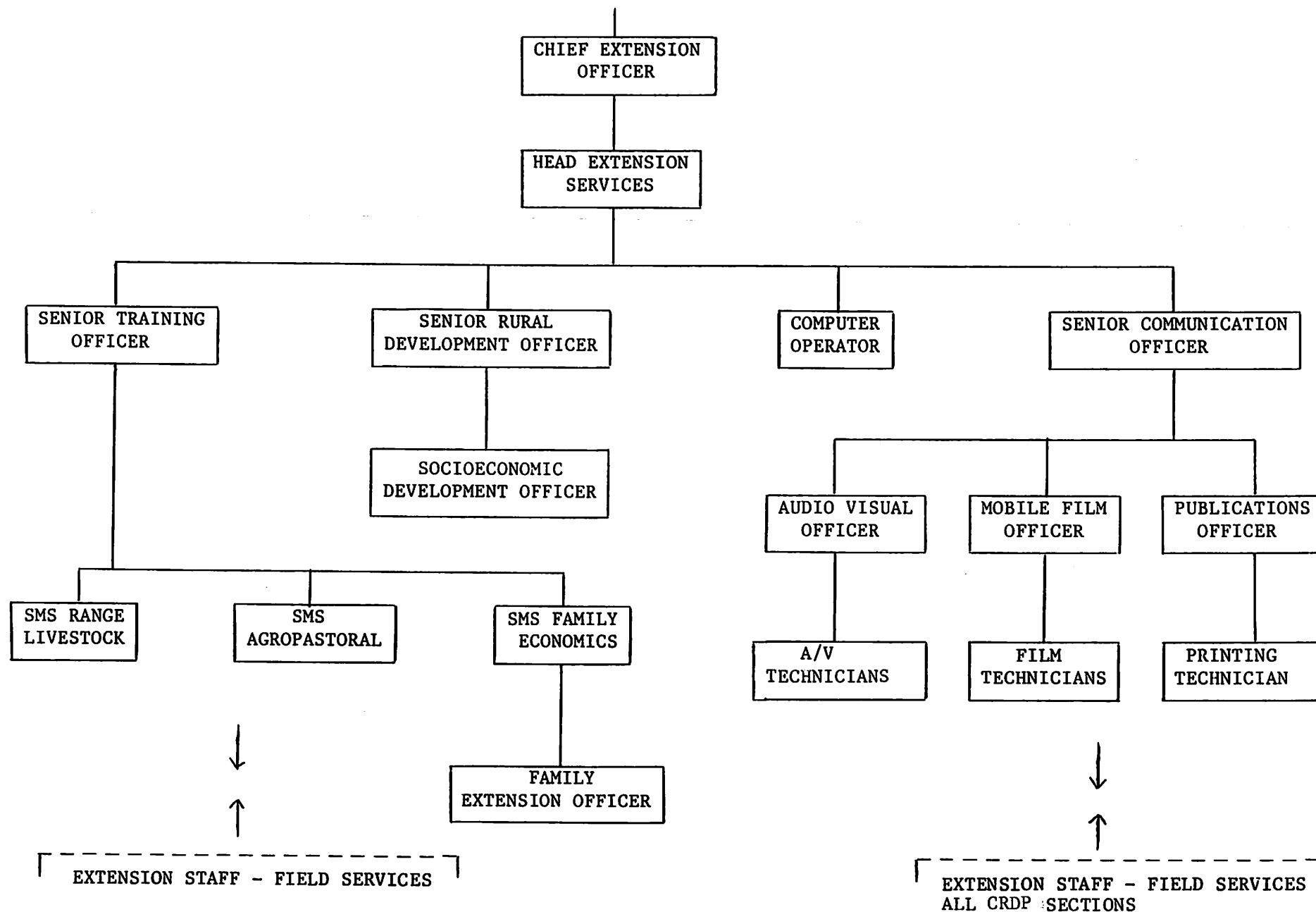


FIGURE A2.4 : CENTRAL RANGELANDS DEVELOPMENT PROJECT PHASE-II PROJECT ORGANISATION - EXTENSION SECTION



11. Under this organisational system, pastoralists would normally only deal with two project officers, the DEO and a VEW, thus facilitating the development of a good working relationship, and avoiding confusion. The responsibilities of the DEO and VEW are specific, so they would be easy to supervise. However, they would have to deal with all aspects of range development, including livestock husbandry and health, range management, soil and water conservation, water development, forestry, agro-pastoral development and socio-economics. Thus, at times they would receive assistance from other DEOs, DROs, or SMSs with specialised skills.

D. EXTENSION METHODOLOGY

12. The extension methodology used would be a product of the experience of the first phase (Holt, 1986); experience from many other similar projects (Agricultural Research and Extension, An Evaluation of World Bank Experience, 1985); and the need to tailor the system to local circumstances. It would be essentially based on the Training and Visit (T & V) system (Benor, D., and Harrison, J., 1977) with some modifications to suit local conditions and requirements. The T & V system relies on systematic visits by extension staff to contact pastoralists or farmers, supported by systematic, frequent and regular short in-service training for the extension staff. The success of the system relies on a number of factors including:-

- (a) Good mobility so that the extension staff can meet frequently with the contact agro-pastoralists and pastoralists, and so the staff can meet for training.
- (b) The target group must be relatively sedentary, so they are easily contacted.
- (c) The extension service must have sufficient proven technology to extend in order to justify regular and frequent visits to contact farmers.

13. In the nomadic pastoral areas of Central Somalia, where distances are great, roads poor, pastoralists continually move, and only limited technology is ready to transfer to pastoralists, the T & V system requires modification. Thus, the T & V system for the project would be used to serve the more sedentary agro-pastoral areas, while in the pastoral areas different approaches would be used. The approach adopted is termed Investigation, Training, Demonstration, and Visit (ITDV).

14. Emphasis would be placed on investigations using case studies, surveys, and meetings, so the extension staff can develop a good understanding of the local problems, and the socio-political, economic and husbandry aspects of the production systems. Demonstrations of technology would also be emphasised and based on past experience. Priority would also be given to using and supporting RLAs and existing community groups, so local pastoralists and agro-pastoralists could make a sustainable contribution to developing their area.

INVESTIGATION, TRAINING, DEMONSTRATION AND VISIT SYSTEM

Investigation

15. The extension staff need to develop a good understanding of the production systems in which they would work. The pastoral and agro-pastoral populations have considerable knowledge of, and experience in, their environment, having developed sophisticated land use systems which have served them well for centuries. The extension staff also need to clarify the local

decision-making structure, identify individuals, groups, or organisations which can help the extension programme, and determine local problems and constraints. This process is almost complete in the initial three priority districts. In CRDP-II, this would be completed in the other 10 districts in an innovative, systematic and phased manner. The potential extension staff would spend at least a year completing investigations of the production systems as members of a SIMP team, before being appointed as a DEO. On appointment they would undertake the next phase of the investigations (the pre-development studies), in which they would extend their understanding of a sample study area in a production system to all of the area in which they would be working. They would gain this understanding by using case studies, sample surveys and meeting techniques.

16. The third phase of the studies and investigations would be initiated by SIMP and continued throughout the project by the DEOs. This would involve monitoring and evaluating local changes and trends, including the impact of interventions. The project would monitor changed circumstances, opinions, etc., and have sufficient flexibility to respond to problems and changes.

Training

17. A systematic, regular and frequent in-service staff training programme would be a key aspect of the project. A short, 1-2 day training course would be held in each district every month for all extension staff. At least one, 1-3 week-long training course would be held for all the DEOs and Arid Land Foresters (ALFs) each year. This would be supplemented by short courses, study trips and other training. The DEOs and ALFs would spend at least 15% of their working time undergoing in-service training, and the VEWs a little less. The training courses would assist to keep the staff competent, professional, knowledgeable, motivated and co-ordinated.

18. The monthly training sessions would be conducted mainly by the SMSs. SMSs would include the Senior Training Officer, who would be in charge of all project training and assisted by the Range and Livestock, Agro-Pastoral and Family (2) SMSs. They would be assisted by other senior extension staff, including the Senior Rural Development Officer, Socio-Economist, Senior Agro-Pastoral Officer and Senior Communications Officer. The SMSs would have the support of the expatriate Technical Advisers in the training programme. The monthly courses would often involve field work, examining, evaluating and learning from experience. They would be used as an opportunity to evaluate the last month's work, plan the next month's work, and to discuss and feed back results and problems from the field. Normally, three courses would be held each month, one in each of the three regions, and at times they may be combined.

19. The annual or bi-annual short training courses would provide more in-depth training. They would often be run by international professional trainers. These courses would include extension methodology; survey methodology, statistics and data analysis; management and organisation; and rapid herd appraisal techniques. They would normally be held at the Aborey Training Centre in Bula Burti district, where the project would establish adaptive trials and demonstrations, and there is access to good training and accommodation facilities.

20. The Senior Training Officer would be responsible for co-ordinating the project's training programme with other similar local projects, including AFMET and the Bay Region Agricultural Development Project. To make best use of resources, foster co-operation and exchange results, some courses may be shared.

21. With the help of the audiovisual/communication group, the SMSs would procure, prepare and organise sufficient training aids to support the training

programme. These would include suitable training leaflets, booklets, books, visual aids, video and slide shows, film strips and 16 mm films. A general video on project activities would be produced each year and used to promote the project to donors, potential donors and other Government departments and agencies. The SMSs would build-up small training reference libraries in each district and the headquarter's Documentation Centre.

Demonstrations

22. A major feature of the project would be the establishment and utilisation of demonstrations as a method to spread and promote the adoption of new technology. During CRDP-I, project staff and, to a limited extent, members of the local communities, identified some useful development interventions and established demonstrations of technology evaluated and proven by the project. These include sand dune fixation techniques, live hedge fencing using Commiphora spp., dugouts, shallow hand-dug well improvements, well water distribution systems, village reserves, shelterbelts, village shade/shelter tree planting, strip cropping/clearing, pasture improvement, and deworming of livestock. The extension staff would make full use of these demonstrations to strengthen the educational process, and new demonstrations would be established following evaluation of techniques. It is expected that the demonstrations and the associated educational processes, and provision of materials and services, would be a major technique to achieve the project's goals.

23. The demonstrations would cover a wide spectrum. Some would be of technology used by local innovators. The extension staff would continually seek out valuable local innovations, and spread them. Other demonstrations would be the results of research and trials from around the world. Appropriate technology for CRDP demonstrations would also be sought from around Somalia. The senior extension staff would visit, at least every year, other districts, organisations and projects in Somalia conducting research and evaluation of technology which may be useful in Central Somalia. This would include visits to the North-West Agriculture Project, Livestock Health Services Project, Somali National University, AFMET, and the Bay Region Agricultural Project.

24. The demonstrations would be carried out mainly by the project's staff, particularly the extension and agro-pastoral staff. Demonstrations would increasingly be undertaken by private individuals, groups, or local organisations. As much as possible, the demonstrations would be on local, private or community livestock herds, agro-pastoral units, farms and enclosures.

Proven Technology Ready for Demonstration and Transfer

25. The first phase identified and evaluated interventions which, if implemented, would help meet the project's objectives. These include, in order of priority:-

- (a) Live hedge fencing of agro-pastoral enclosures, village reserves, shelterbelts and sand dunes using Commiphora spp. Other potential hedge species require further evaluation in adaptive trials.
- (b) Shallow hand-dug well linings, cement rims, cement aprons, and water distribution systems.
- (c) Internal parasite control by drenching sheep and goats to demonstrate the positive effects on liveweight.
- (d) Sand dune fixation techniques to stabilise moving sand threatening to cover high value resources, such as villages, roads, wells and rivers.

- (e) Establishment of enclosures and village reserves to demonstrate the regeneration of degraded areas by control of livestock grazing, and to reduce sand blowing in villages.
- (f) Use of guttering around iron roofs to collect rain water. Despite the often severe shortage of good quality water, roof guttering water harvest systems are rare. The project would harvest water off the roofs of all its district compounds, and install similar demonstrations in other district villages.

Technology Partially Ready for Demonstration and Transfer

26. Some technology was only partially evaluated during the first phase, although in many cases the interventions are of higher priority than those listed above. However, at least some aspects of each of the promising interventions discussed below have been evaluated, and are ready for demonstration and dissemination:-

- (a) Demonstration and dissemination of locally evaluated exotic and indigenous fodder and grain crops. Examples include crop/fodder mungbeans, and improved varieties of the commonly used crop/fodder cowpeas. The rehabilitation and improvement of rangeland areas using species such as salt-tolerant saltbushes and bluebushes around Ceel Buur and on the coastal plains is encouraging. Initial results indicate that the establishment of highly productive perennial and grass species in enclosures may improve the bush fallow system, reduce erosion, and sustain production.
- (b) Strip clearing and strip pasture and crop establishment to stop erosion caused by shifting cultivation. This would also improve the bush fallow system and sustain production.
- (c) Introduction of agro-forestry techniques into the shifting cultivation system. Multi-purpose trees provide wood for building, fuel and fencing, and dry season and drought fodder, while allowing crops to be produced under their canopy. Other tree uses include improved soil fertility, shelterbelt effect, shade, human food, and medicinal.
- (d) Siting, design, construction, management and maintenance of water catchment dugouts and their distribution systems. The management and maintenance aspects have yet to be fully developed.
- (e) Village shade and shelter tree planting by local villagers in their compounds and on streets. The project would, at least initially, provide seedlings, and demonstrate suitable planting and establishment techniques. Where feasible, multi-purpose fruit/nut trees would be used.
- (f) Deferred and rotational grazing management of some rangeland areas in poor to fair condition.
- (g) Nursery tree seedling production. Private enterprise would be encouraged to participate where it may be economic, such as in the Shebelle River area.
- (h) Shelterbelts of trees and bushes around villages to slow wind and thus reduce blowing sand and dust, and to provide shelter.

36

Potential Technology for Evaluation and Demonstration

27. There are many technological interventions which could contribute to achieving project objectives, as they meet technical, economic and social criteria for selection. However, they need to be evaluated under local conditions, before being demonstrated. Many have been successfully tried elsewhere in Somalia, while others have proved successful under similar conditions abroad. Potential interventions include:-

- (a) Windmills and associated simple pumps and tanks, to pump water from bores, shallow wells and dams/dugouts. Only proven, robust and simple windmill pumping systems would be tried.
- (b) Berkeds (below ground-level cement water tanks) and catchment sealing (roaded catchments) to harvest water in very sandy, waterless areas. Such localities include the Agacaadle area of Ceel Dheer district, and eastern Bula Burti and Jalalaksi districts. The trials would include the use of compacted and crushed ant hills as a sealant.
- (c) Solar powered charging of 1.5 volt nickel cadmium torch and radio batteries. Pastoralists use torches to assist herding and watering livestock. Radio use would be encouraged and solar rechargeable torches tested.
- (d) Multi-purpose fodder production farms in high aquifer areas and, to a lesser extent, where run-off water is available.
- (e) Improving the productivity of abandoned farms using multi-purpose trees and fodder legumes. Much of the rangeland in the agro-pastoral areas has been cropped and is in various stages of regeneration. Areas recently abandoned are often bare and eroded.
- (f) Water harvesting, water erosion control, and range rejuvenation measures including contouring, bunding, checkabarding and pitting.
- (g) Camels, and perhaps oxen power, to clean out dugouts and dig new ones.
- (h) Donkeys or perhaps oxen/cow or camel traction to weed and cultivate. The project would also demonstrate the potential of the strip clearing/cropping/fodder system, supported by agro-forestry.
- (i) Improved pasture, crop and fodder residue use and crop storage techniques.
- (j) Demonstration of commercial seed production techniques.
- (k) Low technology/input techniques for establishing trees in arid/semi-arid areas, including use of microcatchments, mulching, and high watertables.
- (l) Livestock holding grounds, managed by RLAs or other local groups or individuals.
- (m) Robust hand pumps for important, deeper, hand-dug wells.
- (n) Use of hand pulleys and animal traction to draw water from deep wells.

- (o) Use of camels and donkey carts to transport materials, particularly Commiphora spp. brush branches to build live fences.
- (p) Camel riding, the associated production of saddles, harnesses, and training to facilitate transport, e.g. for reserve guards and VEWs.
- (q) Prevention/treatment of pneumonia in sheep and goats. A vaccine is being developed by the GTZ veterinary team.
- (r) Wind and solar electricity generators. Demonstrations would be in the CRDP district compounds.
- (s) Solar powered electric fencing of enclosures and village reserves.

Visits/Meetings

28. Most extension would be achieved through personal contact with the target group; the pastoral and agro-pastoral inhabitants of Central Somalia. The method initiated in the latter stages of CRDP-I, of establishing a systematic and regular visit schedule for extension staff to selected contact pastoralists, would be consolidated and extended. These visits would be undertaken by the frontline extension staff, the DEOs and their assistants, and the VEWs. There would be at least one VEW in each grazing degaan, or traditional grazing area. The DEOs, VEWs, local RLAs and village councils would jointly select the local contact pastoralists and agro-pastoralists. This approach would help the extension staff to ensure that the contact people are chosen from a cross-section of local society, so that different social and economic sectors are represented. The Socio-Economist and Chief Extension Officer would provide advice and training to guide the selection process.

29. Each VEW would have a certain number of contact pastoralists to visit regularly every month. The DEO would often take part in these visits. The number of contact pastoralists (CPs) per VEW would depend on the land use in the degaan and the amount and type of technology to be transferred. In more densely populated agro-pastoral areas, where the people are semi-nomadic and proven technology is available, each VEW would have 80 to 100 CPs. The objective would be to make the visit programme as intensive as possible to rapidly disseminate technology. During the visits, the extension staff would encourage the adoption of technology using education, providing necessary inputs and services, and helping to establish demonstrations. Many of the CPs' enclosures or herds would become demonstrations for other pastoralists.

30. The second aspect of personal contact, proven very important in the first phase, is the use of meetings, workshops, seminars and field days. The DEO and VEWs would meet regularly, at least each month, with the local RLA and village committee, and other important traditional leaders in the area, to discuss their programme in the degaan, and issues which have arisen. These leaders are important communication channels to the target population, and should be fully involved and utilised. The DEOs would also meet with the DRO and local District Government and Party Authorities once per month during regular monthly training visits to district or regional headquarters. This would give them the opportunity to co-operate with, and involve the local authorities in, all development activities.

31. The extension staff would also make use of workshops, seminars and field days to support their programmes. Two or three DEOs in each district would normally combine to run these, assisted by SMSs and other staff. Some may involve all the extension staff from two to three districts. A workshop would be held in each district soon after it became a priority development district.

Delegates from each degaan would attend and discuss the district's problems and constraints, and proposed development activities. These delegates would become valuable future contacts. Workshops would also be organised to address local issues such as water development, sand dune fixation and shifting cultivation.

32. Field days would also be an important technique for disseminating technology. Successful interventions or demonstrations would be used as the focus for field days. The project's 4WD bus and other vehicles would be used to assemble large numbers of people to inspect the field day exhibits. Normally, field days would only last one day.

COMMUNICATION AND EDUCATION AIDS

Audiovisual Aid Production and Use

33. Audiovisual aids have proven (under local conditions) to be a popular and effective method to assist extension, education, and training work. They are often a novelty for the target group and therefore their usefulness is promoted. They are also very important for staff training. CRDP-I developed a good Audiovisual Aid Production Centre in Mogadishu. CRDP-II would strengthen this, establish a small unit at the Aborey Training/Extension/Trials Centre, provide basic equipment in each district, and support a mobile audiovisual extension unit.

34. Slide audio presentations and film strips are useful, cheap and simple audiovisual aids. The project would develop the capacity to produce its own slides, which cannot be developed elsewhere in Somalia. Audio slide shows would continue to be produced regularly to support education, training and public relations. Appropriate 16 mm films and 35 mm film strips would be purchased and used extensively. Video proved a very useful extension and training aid in CRDP-I, and its use would be extended in the second phase. Video technology is improving rapidly and the project would produce its own educational video and promotional film shows.

35. As CRDP-I met some difficulty in getting photographs developed locally, a modest darkroom photographic facility would be established at headquarters to produce photographs for visual aids. The Extension Resources Support Group would be supported with staff training, equipment replacement and some additions, to expand and improve its capacity. The Audiovisual Aids Production Centre would produce most of the project's requirements for audiovisual aids, as well as printing most plans, reports, publications and training/extension literature.

36. The project would produce a regular quarterly newsletter and the bi-annual Somali Range Bulletin, to facilitate communication within the project and with other interested groups. The Somali Range Bulletin is currently the only local professional range, livestock, forestry, agriculture and wildlife literary forum. The production of these and other project publications would be the responsibility of the Senior Communications Officer, with assistance from the Publications Officer and the audiovisual production unit.

37. The SMSs would be equipped with basic audiovisual aids to facilitate their work. Each district office would have a blackboard, pinboard, flipchart, posters, slide/film strip projector, cassette player, and loud hailer. To improve mobility, a mobile film unit would be supplied with most audiovisual aids to support field extension staff during meetings, field days, seminars, workshops, etc.

Radio and Mass Media

38. As the extension service has to reach over 150,000 people spread over 150,000 sq km in Central Somalia, maximum use must be made of mass media. The most important relevant local medium is Radio Mogadishu, which transmits over the project area in medium and short-wave. CRDP-I had two technicians assigned to produce a bi-weekly National Range Agency Programme, as well as other radio inputs. In CRDP-II, these staff would be placed under the daily direction of the Senior Communications Officer in the Extension Section. This Section would provide training and technical support to improve the quality of programmes. These staff would also be responsible for issuing press releases regarding project activities to local newspapers and Mogadishu TV.

E. LINKAGE WITH RESEARCH AND OTHER ORGANISATIONS

39. Reviews of agricultural/livestock extension programmes around the world emphasise the importance of establishing adequate links between research and extension. CRDP-II would do this in a number of ways:-

- (a) Extension staff would take part in all the project's adaptive trials and assist with establishment of the demonstrations.
- (b) CRDP-II's Manager would have control of a budget and equipment, including vehicles, to support research projects recommended by the project, so they can be undertaken by the Somali National University. He would ensure that this research work is focused on problems identified by the extension workers, and addresses the research needs of the project.
- (c) The Extension Section would have four SMSs whose responsibilities, in addition to their other duties, would be to liaise between internal and external research organisations, projects or groups, and the extension staff. The SMSs would provide regular monthly training courses for all extension staff to transmit the results of research.
- (d) The SMSs would be required to visit the main research organisations and projects in Somalia completing work relevant to CRDP-II, at least once per year. These visits would include the Agricultural Research Institute at Afgoi, Somali National University, Bay Region Agricultural Development Project, Agricultural Settlement Project, North-West Agricultural Project, and the Livestock Health Services Project.
- (e) The project would submit yearly plans and reports to the organisations listed above.
- (f) As far as possible, the adaptive trials and extension activities of the project would be complementary to the work conducted by other organisations operating in Somalia.
- (g) The project would provide funds to support a continuing link with ILCA, including study trips by staff to ILCA activities throughout Africa, and regular training and technical advisory visits to the project by ILCA's staff.
- (h) Formal links would be sought with AFMET, particularly to share some staff training courses.

- (i) The senior agro-pastoral and extension staff would maintain communications with ICRAF, IITA and ICRISAT, taking advantage of plant varieties developed elsewhere and reporting their performance in local adaptive trials. Funds would be provided for staff to make short study trips to such organisations. The project would maintain close links with these international organisations to provide access to the latest information and improved plant varieties.
- (j) The project would support an annual professional seminar on range, agriculture and livestock issues. It would be developed as a national forum at which research and extension staff could discuss results. The Senior Communications and Training Officers would be responsible for the project's input.

F. USE OF COMMUNITY GROUPS

Range and Livestock Associations (RLAs)

40. As developed under CRDP-I, RLAs are groups of pastoralists and other users of a degaan. They elect a committee which represents their needs and wishes. Aspects of the RLAs have traditional origins. The first embryonic RLAs were formed in the Northern Rangelands Project almost 20 years ago. Based on their initial performance, CRDP-I planners decided to form RLAs over all of Central Somalia, and give them the long-term responsibility for managing all range grazing and other reserves.

41. The Somali Range Law (passed in 1979) established RLAs as official bodies, to be formed under the guidance of the General Manager of NRA in consultation with local authorities. CRDP-I began forming RLAs in 1982. The project soon realised that simply assisting to reserve land did not provide sufficient reason for reserves (in the opinion of pastoralists), as the difficulties and inconvenience caused by the changes in the grazing patterns had little immediate benefit ^{1/}. It was also learnt that considerable care was needed to ensure that members understood the RLA concept, objectives and committee election procedure. Consequently, the Extension Section in CRDP-I established a detailed RLA formation procedure which allowed the RLAs to participate in the planning and implementation of all project development activities in their degaan. After the initial two RLAs were formed, subsequent RLAs were only constituted when the project had completed local studies, and equipment was available, so management plans could be discussed with the RLAs, and implementation commenced with little delay.

42. CRDP-I has established 10 RLAs and is expected to establish at least another two in 1986 and more in 1987. The three older established RLAs are managing deferred grazing seasonal reserves, two since 1983. All are participating in the planning of project development activities.

43. Both the Mascott report on the project and the seminar on 'Future Range/Livestock Development Strategies for the Central Rangelands of Somalia', strongly recommended the formation of additional RLAs, and that considerable attention and resources be devoted to developing their capacity and ability to become effective pastoral community organisational frameworks for development. There is so much development and subsequent management needed in Central Somalia that, given the natural resources available, local pastoral communities will have to make a significant contribution. Development efforts would be more economic and sustainable if communities provide support and participation, together with the formation of groups (RLAs) for project communication. RLAs

^{1/} The benefits have still to be proven in many areas.

would also represent the opinions of the local pastoral people, and could organise a significant contribution from the inhabitants for the project's development activities.

44. Other possible target groups include traders who wish to develop livestock holding facilities, or groups aiming to grow fodder using water spreading schemes (e.g. proposals for the Wisil area in Hobbio district). Any such proposals would be carefully considered by the Rural Development Group, with advice from the Socio-Economist. Limited project involvement, such as the provision of technical advice and occasional transport, would be a catalyst to stimulate such developments.

45. Pastoral Somalis have no traditional experience with development organisations, or the committee system. In addition, there are no existing and defined groups or organisations on which to base RLAs, except the traditional grazing areas (degaans, as used by CRDP-I). As it is proposed that CRDP-II would continue to form RLAs and give them a greater role and support, a consultant Pastoral Anthropologist would be appointed in the PPF year to investigate RLAs and make recommendations regarding the groups chosen for RLAs, the formation procedure, committee election procedure, and their operation, function and recommended support.

46. The Rural Development Group in the Extension Section would be responsible for the formation of, and overall co-ordination, organisation and support for the RLAs. The existing Government procedure of the General Manager of NRA, working in consultation with the local authorities to ratify the existence of all RLAs, would be adhered to. At the district level, DEOs would be responsible for training, supporting and working with the RLAs in the degaan for which they are responsible. The DEO would be supported by up to five part-time VEWs. He would consult the RLAs about all development activities in their degaan, and progressively give the RLAs increasing responsibility for implementing and managing project activities. Additional advice, training and support would be provided by the expatriate Socio-Economist and his Somali assistant.

47. As recommended in the Mascott report and the CRDP development strategies seminar, SoSh 85,000 per year per RLA would be provided to support establishment and training, and to provide funds for local development activities in consultation with the project. After the first two years, the funds would progressively decrease to SoSh 42,500 per year, as the RLAs would be expected to become increasingly self-sufficient. The funds would be used for:-

- (a) Financing internal study trips by committee members or other delegates to different demonstration/development/research sites in Somalia, to study technology which has application in their degaan. The local DEO and DRO would supervise the use of the funds, with the Senior Rural Development Officer providing overall direction. All proposals to use the funds would be subjected to the normal project financial procedures.
- (b) Funding the provision of part-time typing, secretarial or accounting expertise from the local community to support the RLA, and train RLA members.
- (c) Funding small-scale range development activities which the RLA members consider are a high priority. In the formative stages, the local DEO and the DRO would provide technical advice and supervision, and ensure that the needs of the RLA members and CRDP-II are being properly represented. This would provide a stimulus for the RLA committees to function satisfactorily. With

committee elections every two years, other members would have the opportunity to evaluate performance.

- (d) Finance RLA meetings, field days, workshops and range development demonstrations.

48. It is expected that the RLAs would gradually take on more rural development responsibilities, such as the maintenance and supply of livestock water, treatment of livestock health problems, provision of livestock health medicines (administered through NAHAs), provision of livestock holding grounds, and management of range grazing reserves. The project would take care not to overload the RLAs by giving them too much responsibility too soon. RLAs would continue to be formed slowly, after the appropriate procedures had been followed, and project support and development interventions fully prepared.

Village and District Communities

49. Local Government has the primary responsibility for rural development and therefore the project staff (particularly the extension staff) would liaise and co-ordinate closely with the local authorities. This system was established in the first phase, and would be formalised in CRDP-II. The District Mayor is elected by the community and is a key participant in all district development activities. The District Commissioner, appointed by the Government to be the District National Government Representative, and the Party Representative, are also key local leaders with whom the project staff would work closely in all development activities. The above three representatives have previously played major supportive roles in the formation and operation of RLAs.

50. The Village Committees, which represent each village, are of considerable significance. These are supported by a Village Party Committee. To a varying degree, Village Committees have an influence over development within the village, and often within 1 to 2 kilometres radius. They are organisations which would be given an increasing role in CRDP-II for development in villages. Such development would include the village tree planting programme, village shelterbelts, water supply quality and distribution improvement, village reserves, sand dune fixation, and many of the demonstrations. For CRDP-II developments to be sustainable, it would be essential for the project to assist local communities and authorities to contribute to plans and undertake and maintain development interventions. Village Committees are the best village-located groups, while RLAs would be used to serve the broader pastoral and agro-pastoral development activities.

51. A consultant Pastoral Anthropologist employed in the PPF year would recommend whether there are suitable religious or other groups with which CRDP-II should work. There are many Muslim religious groups in Central Somalia who often undertake some localised development activities. CRDP-I has had some success working with these groups, for example, digging and improving shallow hand-dug wells, and stabilising sand dunes. Frequently, such groups or community organisations lack heavy transport, so occasional provision by the project would be a significant contribution to development.

G. RURAL DEVELOPMENT AND ENTERPRISE DIVERSIFICATION

52. A strategy for the project to meet its objectives is to stimulate local communities, and private enterprise rural development and income diversification activities. The project aims to identify and evaluate appropriate technological interventions. Adoption would then be stimulated through demonstration, encouragement, education, training, provision of limited inputs, establishment of RLAs and encouraging other organisations which are also able to assist.

Identification of Appropriate Enterprises

53. The project would establish a defined procedure for identifying and selecting enterprises worthy of support, and then regularly monitor and evaluate the success of the ventures to refine and alter further plans. The overall criteria for selecting ventures would be that potentially they would have to contribute towards the project's objectives. The ventures would be initially identified by:-

- (a) Holding discussions with local pastoralists/agro-pastoralists, RLAs, Government officials and authorities, commercial people, and other interested groups, organisations and individuals.
- (b) Reviewing potential ventures identified in the first phase, e.g. fodder production units, veterinary clinics, barefoot veterinary assistants, etc.
- (c) Obtaining suggestions from project staff, particularly staff with technical roles.
- (d) Through regular communications, study tours, seminars, etc., to gather suggestions from other projects, organisations or areas, both within Somalia and internationally.

54. Following initial identification, possibilities would be evaluated to determine whether they should be supported. The criteria would include the suitability of the venture to Central Somalia; its social, cultural and political acceptability; its potential economic and environmental impact; its potential to diversify and improve the local economy; its contribution to improving the welfare of the inhabitants and national objectives; and potential of the venture to ensure that the project's interventions are maintained and built-on by the local communities and/or individuals. The Socio-Economist, Chief Extension Officer and Technical Manager would be the key Technical Advisers who would help the Extension Section's Rural Development Group to identify, stimulate and support these activities.

Rural Community Development Enterprises

55. Some ventures are more suitable for adoption by community user/producer groups, or other community organisations and groups, than by private enterprise. The project would form and support many RLAs which are range user/producer community groups and which could potentially accept responsibility for many development enterprises. The adoption of ventures such as those listed below would provide the RLAs with a logic for their development and consolidation. Other community groups include Village Committees, District Authorities and Religious Organisations.

Direct Project Supported Community Ventures

56. Sand Dune Stabilisation. During the first phase, some village communities, including Jameco Shiin, Jameco Mukatar, Jacar and Jalalaksi, voluntarily worked with CRDP-I to fence and stabilise local sand dunes which threatened to cover roads, wells, etc.

57. Management of Water Supplies. Local communities and individuals in Central Somalia often keep water bores operational when the Water Development Agency or CRDP are unable to assist, by providing fuel or oil and then collecting money from water users to cover costs. This initiative would be built-on to manage project water bores (refer Annex 5). Similarly, RLAs or

44

other local groups could be given responsibility to manage and maintain project dugouts. The legal aspects of such arrangements would need to be clarified.

58. Roads. The poor quality of many roads is of local community concern. Many existing roads have been cleared or widened by community, manual, self-help projects. Improving the main arterial roads is likely to provide a significant stimulus to the local economies. The project would make modest improvements to some roads with its bulldozers, graders and trucks. This would be completed in co-operation with local community groups. For example, some roads are too rocky to grade, so voluntary community projects would be encouraged to clear stones.

59. Livestock Health. The first RLAs requested livestock medicines and drugs and assistance to diagnose and treat livestock health problems. The Nomadic Animal Health Assistant (NAHA) programme and drug revolving fund were subsequently established in 1986, and would be extended to much of the project area in the second phase 1/. The NAHAs would be local pastoralists chosen by the RLAs, and drugs would be provided on a revolving fund basis, directly to the RLAs.

60. Management Reserves and Shelterbelts. RLAs had a major role in managing grazing reserves in the first phase. However, this activity is generally not very popular. If grazing reserves are to have a lasting impact, local pastoralists would have to support them, and have a role in management.

61. Village shelterbelts can only survive in the long-term if local inhabitants support their existence. Neither the project nor NRA can afford to pay staff to guard every village shelterbelt. Therefore, community groups, such as Village Committees, would be given increasing responsibility for shelterbelts.

62. Village Tree Planting. The quality of life in the hot, dusty and bare Central Somali villages can be improved by extensive village tree planting. This can be economically and simply achieved by giving seedlings to private individuals to plant in their compounds. CRDP-I also had success within its limited programme of providing seedlings to commercial shop owners to plant in the streets. The success of street planting would be enhanced if the Village Committees were involved and supported the project.

63. Shallow Well Improvement. The first phase had considerable success with a programme to improve the quality of water and the life of shallow hand-dug wells, and the water distribution systems. Increasingly, local communities were asked to contribute to this intervention. The second phase would continue and extend this programme to other districts. The construction unit would improve the first few shallow hand-dug wells in each new district, using local labour and expertise. The experience of the first phase suggests that once the first few demonstrations are completed, communities would be prepared to pay for additional well improvements.

64. Schools. RLA members often mention schools as a priority for support. A major technique of the extension programme would involve supporting range management education in local secondary schools. DEOs would work with teachers to encourage students to plant and care for trees in shelterbelts and villages. The project would provide tree seedlings, transport and advice. Similarly, students would be involved with sand dune fixation, shallow well improvements and other community activities.

1/ Initially through GTZ's veterinary activities.

Indirect Project Supported Community Ventures

65. Market Facilities. CRDP-II would indirectly assist with the construction of livestock holding facilities through the provision of expert technical advice on fence construction.

66. Furniture, Souvenir and Utensil Production. The project would provide advice and indirect support for groups or individuals wishing to produce saleable products from local resources. Examples include leather products, furniture, grass mats and containers.

H. DIRECT SUPPORT FOR PRIVATE ENTERPRISE

67. The project would attempt to stimulate and support the local economy whenever possible. In the case of the project's construction programme and the drilling and equipping of water bores, preference would be given to local contracting firms. Major project activities would directly help small private pastoral and agro-pastoral producers. These include the agro-pastoral activities of crop, fodder/livestock and wood production. The livestock health and husbandry programmes would directly assist individual, small-scale and private pastoralists.

68. Many other private enterprise ventures which the project would support directly are either new to the area or uncommon. These require careful evaluation before being implemented. They include private enterprise to supply, distribute and maintain windmill water pumps, portable solar battery chargers, rechargeable torches, agro-pastoral equipment and supplies (livestock tillage equipment, camel carts, etc.), animal traction scoops for cleaning out/digging dugouts, and guttering to harvest water off house roofs. Other enterprises include the supply of improved crop, pasture/fodder and vegetable seeds.

I. INDIRECT SUPPORT FOR PRIVATE ENTERPRISE

69. The types of private enterprise which the project would indirectly support include specialised livestock fattening operations, fodder production units, livestock drug supply, local schools and nurseries, and marketing and trading facilities. These would be indirectly supported by the project's ongoing development programme. Road improvements, for example, would indirectly stimulate the economy. Similarly, agro-pastoral extension activities would be expected to stimulate fodder production units and specific livestock fattening operations.

J. LINKAGES WITH OTHER ORGANISATIONS

70. Communications, infrastructure and service centres are not well developed in Central Somalia. CRDP-II is in a unique position to provide an indirect, supportive framework for other smaller aid organisations. The first phase established a successful and mutually supportive informal relationship with OXFAM. Many useful training courses and workshops were held for local producers. Small aid organisations frequently do not have the technical expertise which CRDP-II would have, and which is needed to identify development interventions. The Socio-Economist and Senior Rural Development Officer would document potential interventions and encourage other organisations to adopt them.

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

AGRO-PASTORALISM

AGRO-PASTORALISMTABLE OF CONTENTS

	<u>Page</u>
A. INTRODUCTION	1
B. ORGANISATION	2
C. OBJECTIVES	2
D. STRATEGIES	3
E. ADAPTIVE TRIALS	4
Infrastructure	4
Adaptive Trials Programme	4
Priority Trials Already Initiated	5
Proposed Agronomic Trials	7
Other Trials	8
F. BULA BURTU SEED MULTIPLICATION, STORAGE AND TESTING CENTRE	9
Introduction	9
General Operation	10
Organisation and Staffing	11
Training and Consultancies	11
Centre Development	11
G. NURSERIES	12
H. VILLAGE TREE PLANTING	14
I. VILLAGE SHELTERBELTS	14
J. LIVE FENCES AROUND AGRO-PASTORAL COMPLEXES	15
K. EXTENSION ACTIVITY AND AGRO-PASTORALISM	15
Introduction	15
Demonstrations	15

AGRO-PASTORALISM

A. INTRODUCTION

1. A common problem in crop and livestock development projects is the failure to recognise the interaction and interdependence of crop and livestock production in project design. This was the case in CRDP-I. The resource survey for CRDP-I in 1979 provided the first indication, after the project design was completed, that there was also a significant amount of cropping in Central Somalia and that it was closely integrated with pastoralism. In 1983, a year after the project's technical team arrived, extension and ecological investigations began to show that the majority of pastoralists in some districts were actually agro-pastoralists; people who practiced both cropping and livestock production. Investigations found that much of the arable bushland and range had actually been affected more by the cropping cycle than by nomadic grazing of the rangeland during the fallow cycle (Herlocker and Ahmen, 1986).

2. Agro-pastoral development activities are expected to provide significant project benefits. The agro-pastoral areas have potential for increased production and improved natural resource conservation. The rainfall is generally higher in these systems and therefore the potential vegetative production is also higher. In the agro-pastoral systems, it is possible to change the management of the production systems because agro-pastoralists fence the land and control grazing.

3. The CRDP-I Extension Section began an investigation into the agro-pastoral system in Ceel Dheer district in 1983 (Holt, 1985). Severe degradation and erosion around new water bores and the formation of some active inland sand dunes in the sandy agro-pastoral production zones was found to be associated with shifting cultivation practices and associated intensive grazing. The area of rangeland being enclosed for cropping and private grazing appeared to be rapidly increasing, although the initial resource surveys (RMR, 1979) suggested only that about 3% of Central Somalia was fenced for private use.

4. Preliminary extension investigations and adaptive trials suggested ways in which the agro-pastoral system could be modified to make it less ecologically destructive, and more sustainably productive. The results of three season's adaptive trials identified many technological interventions with potential. Introduced crop varieties have doubled local yields. Extension case studies indicated that a few innovative agro-pastoralists reseeded farmland with productive fodder plants. Preliminary refinements of these techniques tripled available pasture production to 2,400 kg dm/ha, one year after pasture establishment.

5. A very effective technique to construct live fence hedges using Commiphora spp. has been developed. It promises to reduce the damage caused by cutting and carrying thorn bush trees to fence enclosures near water points. Strip cropping, strip clearing of narrow strips, pastures, windbreaks and agro-forestry are also techniques with potential. Preliminary results suggest they would reduce erosion while providing other benefits. A few agro-pastoralists are beginning to try these techniques spontaneously.

6. Agro-pastoral rainfed cropping activities provide about a third of the food for the inhabitants of the project area. Livestock production is closely inter-related with cropping and enclosures, with many livestock dependant on grazing crop residues and enclosed pastureland for some periods. Where cropping is possible, the introduction of this activity into the pastoral system normally increases productivity. There is a trend towards agro-pastoralism in most of the rangelands of Africa. The challenge is to guide the process so that the

increase in production is sustainable and the detrimental effects on the environment are reduced to an acceptable level. Somalia would thus benefit by being able to feed and support more people and by being able to more easily and cheaply provide services to a population which is inevitably becoming more sedentary.

7. For the purposes of development, the activities of forestry, agriculture and pastoralism are combined into a single inter-related group under the title of agro-pastoralism. This reflects the ecological and economic realities existent within the Central Rangelands, where the quality, quantity and availability of trees and shrubs and the intensity and duration of agricultural cropping and forage utilisation by livestock are strongly interactive. They act both separately and in an integrated manner on each pastoral and agro-pastoral household. Forestry in particular must be defined broadly, not in terms of block forest plantations which may be uneconomical, but as a supply of browse, shade, fencing protection against wind and soil erosion, rejuvenation of soil fertility and a source of fuel (wood and charcoal) and building materials.

B. ORGANISATION

8. All agro-pastoral activities would be co-ordinated and technically directed by an expatriate Head of the Agro-pastoral Section (HAS), and his counterpart, the Senior Agro-pastoral Officer (SAO). All district agro-pastoral activities would come under the responsibility of the Arid Land Forester (ALF) and District Extension Officers (DEO), refer Figure A2.3 in Annex 2.

9. The Plant Material Technical Officers (PMTO) would, under the ALFs, operate nurseries, shelterbelts, village tree plantings, as well as helping with the adaptive trials, demonstrations and general agro-pastoral extension as needed. DEOs would hold field days, establish on-farm demonstrations and provide agro-pastoral services and limited inputs (seed, etc.).

10. The Agro-pastoral Section would establish a close working relationship with organisations conducting basic and applied research so that it could concentrate on adaptive trials and extension. Technology developed elsewhere would be evaluated locally before being demonstrated and extended to the target population.

11. Within Somalia, relevant agro-pastoral research is being undertaken by the Agricultural Research Division of the Bay Region Agricultural Development Project and the Agricultural Research Institute at Afgoi. CRDP-I established an informal relationship with these two Research Centres. This would be strengthened in CRDP-II by the senior agro-pastoral staff making seasonal visits to these organisations to exchange information. The project would continue to purchase seed of the most promising varieties tested by these Centres. However, in the case of pasture and tree species, CRDP-II would have to obtain seed and technical advice from overseas sources such as ICRISAT, as the project area is arid and its agricultural production systems are closely integrated with livestock.

C. OBJECTIVES

12. The SIMP and pre-development studies (refer Annex 1) would seek to gain a clearer understanding of the agro-pastoral production systems. This knowledge would provide the foundation for the agro-pastoral activities. The objectives of the Agro-pastoral Section would be:-

- (a) To identify and evaluate under local conditions suitable agronomic, pastoral and forestry technology which promises to conserve natural resources, increase sustainable production, and improve the welfare and living standards of the target population.

- (b) To ensure that the technology evaluated is rapidly adopted by the local inhabitants and is sustainable in nature so that it has a positive long-term impact.

D. STRATEGIES

13. Strategies to achieve the above objectives include:-

- (a) The dissemination of interventions evaluated in CRDP-I and further refinement through continued testing.
- (b) Identify possible agronomic, pastoral and forestry technology by:-
 - (i) constantly searching for local innovations,
 - (ii) considering technology proven appropriate under similar conditions abroad, and
 - (iii) seeking out proven technology from research institutions, project groups and other areas within Somalia.
- (c) Establish two main project-supported adaptive trial sites, one at Nooleeye in Ceel Dheer district, and one near Bula Burti in the Bula Burti district.
- (d) Establish six plant species elimination and growth trials at a range of potential development sites. These would identify and begin to evaluate potentially useful plants under Central Somalia conditions.
- (e) Establish multi-purpose adaptive trials in high aquifer areas.
- (f) Establish a Seed Multiplication and Storage Centre, and a seed procurement programme capable of supplying the large quantities of good quality seed needed.
- (g) Technology which has been proven successful in trials, would then be tried on some co-operative demonstration farms or similar units. These results would be monitored and evaluated to establish whether the technology is appropriate under local social, political and economic conditions.
- (h) The technology would then be disseminated to the target population through an intensive extension programme, and the results monitored to provide feedback. Technology already evaluated by the first phase would be extended immediately, while the other interventions are subjected to testing.
 - (i) The initial selection criteria and the evaluation processes would have a practical orientation and involve local communities in all stages.
 - (ii) The administrative and functional ability of rural community groups (RLAs) would be supported and they would be consulted and encouraged to be actively involved in all aspects of agro-pastoral development. Similarly, the approach would be to train and support local private enterprise to provide inputs and services and assist with implementation of the development strategies.

E. ADAPTIVE TRIALS

14. Two project-owned and operated adaptive trial sites would be established, one at Nooleeye in the Agro-pastoral Sands (APS) production system and the other near Bula Burti in the Agro-pastoral Clay (APC) (Shebelle Valley) system.

Infrastructure

15. Nooleeye Trial. At Nooleeye, 25 ha have already been acquired on the edge of the town and adaptive trials commenced in April, 1985. The project would build and equip stores, a workshop/laboratory, two shelters and an office on the southern edge of Nooleeye township next to the trials. One two-bedroom house would be built for the Trials Officer in charge and rooms with living areas and verandahs for two Agro-pastoral Technical Officers would also be constructed. A small compound of local huts would be hired to house visiting staff who would spend extensive periods at the site for supervision and training. A simple local bush shelter would be built in the centre of the trial site to shelter workers and guards. All the buildings would be made from local stone, cement and plaster, with an iron roof, ceiling, louver and mosquito screen windows, and a local bush verandah/shelter. A pipe would be provided to supply water from the nearby water bore tank and a small berked (cement tank) built to store water. A small wind/solar powered generator would be erected as a demonstration and to charge batteries to provide lights for the buildings and a two-way radio communication system.

16. Bula Burti Trial. Use would be made of the existing CRDP-I district compound at Bula Burti as a Trial Centre and the Aborey Training Centre ^{1/} facilities as an out-station to minimise capital costs. Two stores, a workshop/laboratory and two shelters would be built at the Bula Burti compound. The site would be chosen after preliminary investigations of the Shebelle Valley area and local soils to ensure that suitable representative areas are selected. Sites would be within 20 km of Bula Burti township, so all the accommodation, stores, etc., would be located in the existing CRDP compound, except for on-site guard huts. Two two-bedroom houses would be provided for the two professional Somali positions, and two single units for the Technical Officers. Two local brush-type staff verandah/outdoor shelters would be provided at the compound, and two huts for the guards at the site of the adaptive trials. Buildings would be of the types described for Nooleeye.

Adaptive Trials Programme

17. The Head of the Agro-pastoral Section (HAS) and other senior staff who would be responsible for the adaptive trials would be given the flexibility to alter and redirect their programmes, to take account of the results of the SIMP investigations, the preliminary trials and their own experience.

18. The following adaptive trials/demonstrations were identified as priorities by CRDP-I. Most have already been initiated at the Nooleeye trial site. They are adaptive trials rather than basic research investigations as the objective is to develop, evaluate and demonstrate technology, equipment and materials which have generally proven successful and appropriate elsewhere under similar conditions.

19. Some of the trials would be undertaken on a network of co-operative private agro-pastoral enclosures in addition to the project's two adaptive trial sites at Nooleeye and Bula Burti. These would be used as demonstrations and for

^{1/} Ministry of Interior - relatively unused, almost new facility probably available through negotiations.

training, as well as providing an opportunity to evaluate the technology in a wider range of micro-environments and conditions.

Priority Trials Already Initiated

20. Some interventions were evaluated by the first phase and are now ready for dissemination. However, all require further adaptive testing before their full potential identified.

21. Live Fencing Trial. There is a very high priority to further develop, evaluate, demonstrate and disseminate methods and techniques for live hedge fencing of enclosures. Particularly near villages in the agro-pastoral zones, frequent cutting of bushes and trees to construct and maintain thorn branch fenced enclosures is a major contributor to the degradation of these areas. In addition, the lack of bushes to construct fences near established villages often forces agro-pastoralists to abandon previously farmed enclosures. Such enclosures are very susceptible to erosion and without fences to protect them from heavy stock pressure near villages, they often become badly degraded very quickly. Commiphora spp. have traditionally been used in East Africa for live fencing. While their use for this purpose in the project area has been limited, CRDP-I has further developed the technique. Many kilometres of live fences and live windbreaks were constructed for both fenced reserves or shelterbelts, and to stabilise active sand dunes. Such fences are effective, long lived and can be built without the need for foreign exchange.

22. The technique could be further improved by simple trials and investigations. The results would then be demonstrated throughout the project area by incorporation in village reserves, etc., and then disseminated to the target group through extension. Firstly, an investigation of the various species and varieties of Commiphora used by CRDP-I for fencing would be made to determine which are the best. Large differences in vegetative establishment have been observed between species. Information on the optimum storage period, and time and depth of planting of cuttings would also be collected and utilised. Secondly, a trial would be conducted to determine the most effective length and type of cutting. At present, large branches 1-1.5 m high are planted. While this has the advantage of creating an instantly effective fence if the branches are planted closely together, it is very destructive and requires a considerable transport effort. If successful, small cuttings could be planted with little effort around the inside edge of existing thorn fences, where they could grow to provide an effective fence within a few years. Similarly, the potential of direct sowing Commiphora seed would also be investigated.

23. Many other bush and tree species have potential for live fencing and would be evaluated at Nooleeye and Bula Burti. Seed and plant material of promising local species would be collected on a contract basis, and seed of exotic species purchased. Trials would be set out to determine species usefulness for live fencing, and to determine suitable densities and cultural techniques. The objective would be to develop plant material and cultural techniques which have practical and local application for fencing. Techniques which require the least work, such as growing from seed rather than cuttings would be promoted.

24. Agro-Forestry Trial. There are potential benefits from increasing the role of trees and bushes in the agro-pastoral systems. In addition to acting as fences, trees and bushes have potential for supplying wood for building and fuel; dry season, drought and famine fodder reserves for livestock; famine food reserve for people; windbreaks to reduce erosion and increase crop and fodder production; natural fertiliser for the soil; and shade and shelter. Trials would be established to evaluate the potential of suitable multi-purpose

trees. Trials have commenced with the local Terminalia spinosa (Hara) tree at Nooleeye 1/. Other trees, including Acacia senegal and Acacia albida would be included. Unlike most trees, these allow cropping under the canopy so the cropped area is not reduced while wood and dry season fodder are produced and soil fertility is improved. One trial would establish rows of these trees across farms and then cultivate beneath them to evaluate whether the sustainable productivity of the system is enhanced. Terminalia spinosa is a priority for evaluation as it grows naturally over much of Somalia, is an excellent wood and a reasonable dry season fodder species. The wood is termite resistant, makes good charcoal, and is straight, thereby commanding a high price in Somalia as a building material. The trial would measure such factors as the growth rate of the trees, the quality and quantity of forage produced seasonally, and associated agricultural crop production. Practical direct sowing for establishment and cultural techniques would be developed. An evaluation of the capacity of the trees to coppice (re-shoot after cutting) and to improve the soil if the leaves are used as a green manure would be conducted. This technique may extend the cropping period of land before it becomes exhausted, and thus increase productivity. Another trial would evaluate various techniques to reduce the fallow period of exhausted farmland before it can be re-cultivated, whilst at the same time increase the production of pasture and forage. Most land in agro-pastoral areas is old abandoned farms in the fallow phase of the cropping cycle. When newly abandoned, the land is typically bare. Suitable introduced trees and pasture species can quickly become established. Legumes, in particular, would be given priority in the programme. Preliminary trials have already begun at Nooleeye and Ali Yabal (Ceel Dheer district). The results are encouraging.

25. Strip Clearing Trial. Typically, agro-pastoralists clear all vegetation from a roughly circular area of 1-3 ha, prior to cultivation. Such a field is 110-190 m in diameter. Without vegetative cover in the sandy agro-pastoral zone, the farms are often eroded rapidly by strong local winds once the soil surface is disturbed by cultivation. If the rainy seasons are poor for two consecutive years, all fertile topsoil can be lost. Loss of much of the fertile topsoil layer over 5-8 years of cropping is very common. This is a major factor causing a decrease in productivity. An effective method of preventing this desertification is to clear narrow parallel strips of land for cultivation, rather than large blocks. The uncleared strips act as windbreaks, protecting the cropped strips from erosion. Trials are needed to determine the appropriate strip width and to test associated improvements such as felling and removal from the pasture/windbreak strip of all bushes and trees which are known to compete for moisture, as well as all unpalatable and undesirable species. As a further intensification, additional productive fodder legumes may then be sown. Demonstrations of simple, basic strip clearing would be established on private agro-pastoral enclosures throughout the sandy agro-pastoral zone as a high priority.

26. Strip Cropping/Pasture Trial. Trials would be established on local, conventionally cropped fields to stop erosion by establishing parallel, alternate, adjacent crop and pasture strips at right angles to the prevailing winds. The pasture strips would act as windbreaks and protect the cropped strips, while at the same time provide fodder and improve the fertility of the soil. Trials are already underway at Nooleeye and Ali Yabal. These aim to establish a high proportion of perennial, local and exotic pasture legumes and the productive tussock grass Cenchrus ciliaris in the pasture strips. Trials are needed to determine the most desirable strip width in terms of crop and

1/ The GTZ/GOS forestry component associated with, but independent of, CRDP has an ongoing programme to test and evaluate a wide range of species for woodlot and village planting.

pasture production, ability to reduce erosion, and local acceptability. Simple demonstrations would be established on private holdings as a matter of priority.

27. Species Elimination and Growth Trials. Elimination trial plots of promising trees, bushes and in some cases crop and pasture species would be established throughout Central Somalia. These would be co-ordinated with similar programmes in other parts of Somalia. Both promising local and introduced species would be included. The number of species tested in this way for local survivability and growth/production would be kept to a minimum by including only those with desirable characteristics and which have proved useful in other similar environments. Each species would be sown in at least two different wet seasons, and evaluated for survival and growth under rainfed conditions. Promising tree and bush species (except those being evaluated for shade purposes only) would subsequently be tested for their ability to establish by direct sowing. The species elimination trials would be established at at least six sites, the number being clarified by the SIMP investigations. These sites would include Nooleeye, near Ali Yabal, Aborey, Heredhaley (Hobbio district, north of Wisil) and the Coastal Plains. Some of these trials would be established in the PPF period, so results are available as soon as possible to guide other agro-pastoral activities. The trials would be replicated and designed so that the results can be analysed statistically. At the same sites, a few species with the greatest potential would be planted in growth trials. Production attributes including growth rate and vigour would be monitored.

28. Pasture and Crop Trials. As part of the trials evaluating strip clearing, strip cropping and agro-forestry, promising introduced and local species and varieties of pasture and field crops would be compared and evaluated for productivity, quality and suitability under local conditions. Only varieties identified by the species elimination trials, or known to have a high potential, would be included. Emphasis would be on legumes and perennial pastures. Initial results from mungbean trials, for example, are very promising. Mungbeans are a staple diet in southern Somalia, but rare in the centre.

Proposed Agronomic Trials

29. A number of adaptive trials are needed to evaluate the possibility of improving agronomic aspects of the agro-pastoral systems, particularly in the Agro-pastoral Clay (APC) production system.

30. Soil Fertility Trial. Soil fertility in the pasture, crop and agro-forestry strips would be monitored by regular soil and plant analyses. This would determine which pastures and trees are good soil improvers, and help to determine agronomic and husbandry practices to conserve the fertility of the cropped soil. The soil and plant analyses would be contracted out.

31. Rotation Trials. Before the soils in some cropped strips are exhausted, they would be sown to pasture and the adjacent pasture strip cropped. The soil fertility trial would evaluate the period of time which well established and suitable pastures need to rejuvenate the soil. The recommended length of rotations would be based on this information. If the trials are successful in establishing other food crops, these would be evaluated in rotation with cowpeas to decrease plant disease.

32. Fertiliser Trials. It is considered unnecessary to introduce fertilisers into the agro-pastoral systems at this stage although there may be exceptions which require evaluation. If plant and soil analyses identify serious deficiencies, small trials would evaluate the economic viability and benefits from using fertiliser. Phosphorus is a possibility as it is deficient in many

Somali soils, and in other African countries large yield increases have been achieved using small quantities. Furthermore, the effect from one application continues for many years.

33. These trials would also evaluate the use of local livestock manure as fertiliser. At present it is not often used. As many livestock are yarded at night near the cultivated plots, manure is usually readily available. The potential for altering livestock herd management to leave animals in fenced farms at night during the dry season, rather than in yards, would be investigated. Predators are not common and security is good.

34. Plant Density Trial. The local extensively cultivated indeterminate cowpeas are able to partially compensate for big differences in plant density by increasing or decreasing lateral growth. However, large gaps in crops are commonly observed, often due to poor establishment or plant death. Randomly chosen sections of crop strips sown to local cowpeas would be sown at higher densities, and the production of grain and plant material compared. The trial would be repeated so results are obtained in poor, average and good seasons.

35. Inter-cropping Trial. At present inter-cropping is not a common practice, the exception being the widespread sowing of native sour watermelon with cowpeas. The potential of other species for inter-cropping would be investigated. For example, one or two rows of sorghum could be sown every few metres and cowpeas sown in between. The cowpeas should benefit from the windbreak effect of the sorghum and the sorghum would act as stakes for the creeping indeterminate cowpea varieties. The sorghum may also benefit from the provision of nitrogen by the cowpeas.

36. Crop Disease Trial. The DEO and ALF would identify important local pests and diseases. Adaptive trials would then evaluate their practical significance and if necessary, focus on appropriate control/prevention methods. As in the case of fertilisers, the aim would be to use suitable agronomic practices such as crop rotations rather than use scarce foreign exchange to purchase pesticides. Sorghum appears to suffer from serious pests and diseases. Therefore, the effectiveness and economics of limited strategic spraying would be evaluated. Hand knapsack atomiser-type sprays with low water/chemical requirements would be used to test the effectiveness of this technology.

37. Weeding Trials. The timing, frequency and effectiveness of weeding has a major influence on crop grain and forage production. While to a limited extent this is common knowledge, adaptive trials, good demonstrations and effective extension would increase productivity.

Other Trials

38. High Watertable Trials. There are a limited number of sites in the project area where relatively high watertables exist. These include much of a narrow 10-20 km wide strip extending 500 km along the coast; an area of about 30-40 km² north of Wisil (Heredhaley) in Hobbio district; small areas in western Jalalaksi, Bula Burti, and Belet Weyne districts; near Galkayo in Jiriban district; and near Ceel Buur village. The waters are saline, but are drunk by humans and livestock. Along the coastline there appears to be a shallow lens of medium quality water floating on top of saline water only 1-3 metres below the surface.

39. All these water sources are important for livestock and human use. However, very little other use is made of them. The project would provide a consultancy for a Hydrologist to examine the sites, and recommend whether these water sources could support additional agricultural use without causing

unacceptable deterioration which would affect their use by people and livestock. The consultant would work closely with the Socio-Economist and Ecologist to assess the environmental impact of development. He would also establish a system to monitor the level and quality of watertables where trials are recommended.

40. Groves of Casuarina and coconut palms have established very successfully on the coast at Adadle, 100 km south of Ceel Dheer district, in an area very similar to the coastline or the Central Rangelands. Adaptive trials would check the potential for these trees in Ceel Dheer and Hobbio districts. Casuarina provides a quick growing windbreak and wood. Coconut, date palm, cashew nuts, salt resistant vegetables (such as tomatoes) and suitable perennial evergreen fodder plants including Prosopis spp. (particularly P. tamarugo.) would be tested between groves of Casuarina.

41. In the Heredhaley area of Hobbio district small areas of date palms were successfully established in a large high watertable area many decades ago. The productive potential of these date palms would be investigated and a fodder/food production adaptive trial established. A range of suitable fodder and food production species would be evaluated. Similar trials would be undertaken at other potential sites after preliminary investigations assessed their suitability. Acacia albida would be one of the species tried at these sites. It grows well in high watertable areas, has nutritious leaves, provides firewood, and promotes the growth of crops such as sorghum beneath the canopy.

42. Wherever possible, the adaptive trials would be sited such that they are accessible to villages. Each site of a few hectares in size would be fenced securely (preferably with live fencing) and provided with three guards and a guard's shelter. Where there is no local village, such as at Heredhaley and Mereeg in the Ceel Dheer district, two local-style guard huts would be built for the guards.

43. The district nurseries would provide most of the seedlings, although direct sowing would be evaluated. The trials would be carried out by the ALFs and PMTOs, supervised and directed by the Head of the Agro-pastoral Section, the Arid Land Forester and other Subject Matter Specialists. They would evaluate and monitor the results and change the trial designs accordingly.

44. Other Trials. Other necessary trials would be identified during the course of the project. These could include small-scale trials on micro-catchments and contouring, and bunding and water harvesting in the Agro-pastoral Clay production system. Grain and fodder storage techniques may be investigated to determine whether improvements are needed or practical. The potential for using animal traction and alternative implements for operations such as weeding would also be evaluated. The project would also have an allocation of funds to cover the cost of conducting trials which have not been specified in detail by CRDP-II.

F. BULA BURTI SEED MULTIPLICATION, STORAGE AND TESTING CENTRE

Introduction

45. An essential aspect of the agro-pastoral activity would be the establishment of the capacity to collect, purchase, multiply, test and store seed of many species and varieties of suitable trees, shrubs, pastures and crops for Central Somalia. This would be achieved by establishing a small, efficient, seed multiplication, testing and storage facility at Bula Burti, on the Shebelle River. Bula Burti is the largest of the district centres. It has all-weather road access to the rest of Central Somalia, an airstrip, and other facilities

including a bank. The project has already established a district compound and has a potentially irrigable area on the bank of the Shebelle River, supplied by an equipped irrigation bore. Bula Burti is also a natural Centre for agro-pastoral adaptive trials, including species elimination and growth trials. Excellent facilities on the nearly unutilised Aborey Nomadic Training Centre (which could become a centre for adaptive trials and demonstrations) are only 20 km away.

General Operation

46. The Centre would undertake the procurement, storage and testing of exotic seed needed by the project. Professional exchange arrangements would be established with international institutions including ICRISAT, ICRAF, ILCA and IITA to take full advantage of existing knowledge and to reduce costs. The work would be co-ordinated closely with other projects and institutions in Somalia. In this way, the number of varieties to be stored and tested would be kept to a minimum.

47. The Centre would also be responsible for collecting, storing, testing and, in some cases, multiplying the native plant species seed needed by the project. Some native perennial legume pasture species, agro-forestry and live fence species with demonstrated potential were collected by CRDP-I. The Centre would test the germination of these species and develop germination techniques for nurseries which would multiply seedlings for species elimination and other trials.

48. The project would contract out the multiplication of seed to private individuals, organisations and other projects. Private enterprise would be encouraged to take over this role as much as possible in the long-term. Commercial seed production could potentially be developed as a valuable local industry.

49. After collection or procurement, seed would be tested for germination and processed and stored until required for planting in project nurseries, trials and demonstrations, or in some cases, by other organisations. Drying, treating, sealing and cooling treatments would be provided to maintain seed viability. Samples of all seed would be periodically tested for germination to monitor the viability of all seed stored and released.

50. The Seed Production Agronomist would be in charge of the seed multiplication unit. He would ensure that a suitable site is selected by checking soil profiles, drainage, slope, fertility and salinity, and by investigation of the land use history of the site. He would also check the quantity, quality and reliability of irrigation water. An Irrigation Specialist, assisted by a Soil Scientist and an Agronomist, would further examine the site and prepare a detailed irrigation and drainage site plan.

51. The project's bulldozer and grader would be used to clear, level and build channels for the site. A tractor and cultivation equipment would be provided. Fertilisers, herbicides and insecticides would be used as the Centre would aim to produce as much good quality seed as quickly as possible. Irrigation would be used to obtain reliably high yields. As Shebelle River water levels are often very low, and salinity high, the use of a suitable bore would be investigated as an alternative source of irrigation water.

52. Most agronomic operations would be manual. Weeding and harvesting would be completed by hired seasonal labour, but land preparation and sowing would usually be mechanical.

Organisation and Staffing

53. Organisation. The Officer in Charge of the Centre would be the Seed Production Agronomist (SPA). He would be responsible to the Head of the Agro-pastoral Section who, with advice from the Arid Land Forester (ALF) and other project Agronomists, would decide which seed should be imported, collected, multiplied, stored and tested. He would arrange for the collection of seed of indigenous species through local district extension staff. Similarly, he would arrange, through NRA or other local organisations, for the collection of any indigenous species with potential, from other areas of Somalia.

54. Staffing.

- 1 Seed Production Agronomist (SPA) (Officer in Charge)
- 1 Farm Manager
- 1 Farm Foreman
- 1 Seed Technologist (OIC seed storage/testing)
- 1 Seed Store Assistant
- 1 Seed Laboratory Assistant
- 1 Office Assistant (typing, clerical, etc.)
- 2 Cleaners
- 6 Labourers (4 seed multiplication farm, 2 seed storage/testing)
- 3 Guards/Gardeners (for multiplication farm)
- 1 Pump Operator/Mechanic/general purpose
- Seasonal labour (as needed)

Training and Consultancies

55. The Seed Production Agronomist would receive in-service training from the Head of the Agro-pastoral Section. In addition, he would attend short study trips and courses in Somalia and other African countries to learn from other similar institutions. He would in turn conduct on-the-job training for the Centre's Technical Officers.

56. The Seed Technologist would be given one year's training outside Somalia and would pass this knowledge onto his assistant on return.

57. Consultant Soil Science and Irrigation Design Experts would be employed in the PPF year to work with project agro-pastoral staff to carefully select a suitable site for the seed multiplication farm, and to provide detailed plans of the irrigation system.

Centre Development

58. General Requirements. The Centre would require suitable land, water and power supplies, buildings, equipment, a small staff and labour force and an operation and maintenance fund. The seed storage and testing facilities would be placed close to the existing Bula Burti compound to take advantage of the power and water already available. The Centre would be connected to the town power which is available for a few hours each day, and also to the large CRDP compound generator (50 KVA).

59. General Equipment. The seed storage room would be equipped with a commercial-type refrigerator to store inoculum and seed which requires refrigeration. Wooden shelves, assorted plastic and tin containers and fibreglass bins would also be provided.

60. The seed testing room and office would have laboratory-type benches, balances, microscopes, a temperature controlled cabinet/germinator, drying

ovens, fumigation equipment, moisture control equipment, gas or electric burners, seed testing equipment, seed bag sealing equipment, and stocks of chemicals etc. The office would have desks (2), typewriters (2), cupboards, and seed and general filing cabinets.

61. The external working area would have grinders for plant samples, a seed cleaning machine, assorted sieves, a rotating drum or small electrically operated cement mixer, scarifying equipment and moisture control measuring equipment.

62. The Seed Multiplication Centre's tractor, implement and working area shed would be equipped with work benches, cupboards and a basic supply of service tools. The stores would be provided with shelves and lockable cupboards for chemicals.

63. Vehicles and Farm Equipment. The Seed Storage and Testing Centre would be provided with a small four wheel drive vehicle. The seed multiplication unit would require a four wheel drive pickup, a tractor and cultivator, levelling, spraying and fertilising equipment, and a regular supply of seed, chemicals and fertiliser. It would also have perimeter fencing, and a diesel pump and pipes for irrigation.

64. Buildings.

(a) Seed Storage/Testing. A building of approximately 12 m x 14 m would be constructed. One section (12 m x 8 m) comprising the seed storage and testing area, would be well insulated so it can be efficiently air conditioned, using a system which provides good natural ventilation. The other section would be built with a roof and a wall on one side, low walls on the other three sides and enclosed above with welded iron mesh for security. This semi-open working area would be used for cleaning seed, storing seed to be cleaned, and as a base for cleaning equipment. A 2 m wide verandah to reduce heat would be constructed around the adjacent office storage and cleaning areas. Piped water would be supplied to two sinks in the seed testing areas, and another in the seed cleaning area. Water would be supplied from the CRDP-I compound tank by pipe, and from a roof run-off collection system.

(b) Seed Multiplication. A tractor and implement shed with an attached work area office, seed and chemical stores, and ablutions would be constructed on the site of the seed multiplication farm. Water would be provided by a tank supplied by roof run-off and by a pipe from the irrigation system. The shed and working area would be constructed from local stone, with an iron roof, and open at the front and one side. Welded mesh panels and large front gates would be provided for security. The adjacent office and other rooms would be built from local stone and with a high iron roof, large windows and verandahs for cooling. A local stick and abode-type hut would be built for the guards at a central location to provide 24-hour security.

G. NURSERIES

65. CRDP-I's GTZ-supported forestry component strengthened the large nursery at Belet Weyne and established useful nurseries at the other two Regional Centres; Dusa Mareb and Galkayo. It did not establish nurseries in the District Centres where they were also needed. Therefore, during the course of CRDP-I, the soil and water conservation component established small nurseries in

the three priority districts. Non-priority districts had very small nurseries established by the District Range Officers.

66. CRDP-II would place greater emphasis on arid zone forestry at a community level and as an activity in the agro-pastoral system. The project would establish and consolidate well organised, co-ordinated and efficient nurseries in the 10 District Centres to be developed, and take over the maintenance of the three regional nurseries, after GTZ support terminates at the end of 1990. Two nurseries would be established in Hobbio to serve the needs of this large district. These nurseries would supply the project's needs for tree seedlings for the village tree planting programme, species selection and growth trials, fodder production trials, agro-pastoral adaptive trials, the village shelterbelt programme, and range rejuvenation/sand dune fixation.

67. Village fuelwood plantations would not be promoted as these are not practical under the arid and semi-arid climate conditions. However, the serious and growing need for fuelwood and building materials is apparent and priority would be given to developing commercial private agro-forestry plots. The large quantity of wood needed can only be produced if it is commercially and technically possible for thousands of agro-pastoralists to integrate wood production into their livestock/crop systems. With the tripling in the price of wood during 1984/85, agro-pastoralists are beginning to establish commercial agro-forestry. The district agro-pastoral staff would promote this development through education, demonstration and the provision of seed, technical advice and, when appropriate, seedlings.

68. The project would provide a consultant expatriate Arid Land Forester who would visit periodically to provide technical advice and support to the Somali Arid Land Forester (ALF). The ALF would be responsible to the Head of the Agro-pastoral Section for providing technical advice and direction to district PMTOs. He would thus be responsible for the establishment of seven new district nurseries, maintenance of three regional and three district nurseries, and the organisation of a well planned programme to supply seedlings for all the CRDP-II activities. He would also have a major role in designing and supervising the tree/bush species elimination and growth trials, and would provide technical forestry advice. The ALF would provide in-service training for a Senior Forestry Officer, who would assist him to direct the field staff. This team would give technical direction and advice and assist with co-ordination of all forestry activities in the districts and regions.

69. The ALFs would initially be graduates of the Afgoi School of Forestry, Livestock and Range. As the newly established Natural Resource Management School at the Somali National University begins to graduate ALFs they would be employed. An innovative feature of the programme would be that, in addition to their nursery responsibilities, the ALFs would have a major role in all other district forestry activities. These would include planting and evaluation of the adaptive trials, species elimination and growth trials, fodder production trials, village shelterbelts, and the village tree planting programmes.

70. The size of each nursery would be in proportion to the particular district's tree seedling requirements, and would therefore vary from 10,000-50,000 seedlings per season, with the agro-pastoral system districts generating the greatest demand. Each nursery would be built cheaply from local materials. The nursery seedling shelters would be constructed from local wooden poles with a brush shade roof and stock panel sides, in the fashion of the nursery at Belet Weyne. A store would be constructed as a local Somali-style stick and adobe-type hut with cement inner plastering and an iron roof. Most existing nurseries have been established adjacent to suitable water supplies and all nurseries built during CRDP-II would also have reliable water supplies.

Four existing nurseries do not have small water tanks. These would be provided in CRDP-II. Most existing or potential nursery sites have already been fenced by the project. Live fencing would be used to fence the remainder.

H. VILLAGE TREE PLANTING

71. CRDP-I had considerable success with a programme of distributing tree seedlings to villagers to plant and care for in their small compounds or alongside village streets. As it is a very low cost and effective method of improving the quality of life for rural communities, this programme would be supported and expanded by CRDP-II.

72. Initially, species evaluation and growth trials would introduce and evaluate other indigenous and exotic shade trees in a range of environments. Arid land shade trees not yet tried in Central Somalia would be evaluated, including Shinus mollus (peppertree) and Tamarix (athel pine). Villagers are prepared to use waste water on seedlings until they are established. Thus, a wider range of trees would be used than in village shelterbelts, where it is necessary to grow trees with very low water requirements. Villagers do not water shelterbelt trees voluntarily. Some villages are located over high watertables which could assist tree growth. Under the management of the ALFs, each nursery would supply sufficient seedlings for the shade planting needs of villages each wet season. The ALFs would hold regular tree planting and maintenance demonstrations to educate school children and villagers how to plant and water trees and the importance of livestock protection barriers. Village committees would be encouraged to plant shade trees along streets and in parks. Whenever possible, suitable shade trees with commercial uses, such as date palms and cashew nut, would be planted.

I. VILLAGE SHELTERBELTS

73. Generally, the most heavily degraded areas in Central Somalia are the village/water source surrounds. Much of the vegetation, particularly trees and bushes, has been destroyed within 1-2 km radius. This seriously affects the quality of life of the village dwellers. Without cover, frequent strong winds blow dust storms causing respiratory problems and often swamping houses. The lack of shade is also uncomfortable. The villages and towns are the focal points for all pastoralists and agro-pastoralists who most regularly spend time at the watering points with their livestock and use the services which settlements provide. Therefore, improving the village/town environments improves the quality of life for most of the people.

74. CRDP-I began a programme of planting belts of trees/shrubs (usually 30 m wide) around the windward sides of many villages to reduce the velocity of the wind and thus dust. When fully grown, the trees would also provide shade. Central Somalia is a marginal area for tree growing due to the low 150-350 mm annual rainfall. The major challenge is therefore to identify trees which will grow without supplementary water, except perhaps in the first year or two. As water is generally scarce in Central Somalia and water distribution systems limited, it is only practical to plant shelterbelt trees with very low water requirements. Some, including Prosopis juliflora, P. chilensis, Parkinsonia aculeata and Acacia nilotica are showing promise. The species elimination and growth trials would test other promising drought resistant indigenous and exotic species.

75. Shelterbelts would be a relatively expensive intervention compared with the village tree planting programmes. For each, the project would provide:-

- (a) a secure boundary fence, preferably live fencing,

- (b) a small water storage tank (berked),
- (c) at least two permanent guards/fence maintainers,
- (d) a full-time Technician plus about four (depending on the number of trees) labourers to plant and water trees, and
- (e) a donkey and cart to supply water.

76. To control costs, the project would:-

- (a) locate the village shelterbelts inside fenced village reserves if they are available,
- (b) attempt to reduce the cost of watering by evaluating the use of burden camels, sinking shallow wells wherever possible, and piping water from nearby water bore tanks,
- (c) only establish shelterbelts requested by the villagers and encourage support and participation with planting, establishment and maintenance. This would require considerable extension input, and
- (d) fence and protect trees around water points. Eleven new shelterbelts would be planted and 18 under CRDP-I would be completed in stages.

J. LIVE FENCES AROUND AGRO-PASTORAL COMPLEXES

77. An incentive of SoSh 1,700 for single, privately owned agro-pastoral complexes within the heavily degraded zones near villages would be paid to a maximum of 500 agro-pastoral families. Up to 20 live fences per village would be supported by the project. An incentive of SoSh 1,700 is a small proportion of the costs which would be incurred by agro-pastoralists to build live fences around their complexes, and would stimulate rapid adoption of the technique. This activity would be restricted to agro-pastoral village areas subject to severe degradation, such as Bargan, Jacar, Nooleeye, Garable and Bacaad Weyne. Suitable agro-pastoral complexes would be selected by the DEOs, VEWs and DROs. The incentive would be payable to each agro-pastoralist who built at least 500 m of live fence around the perimeter of his complex. The programme would be organised by the Agro-pastoral Section and would cost SoSh 850,000 for fencing incentives and SoSh 2.38 million for camel and donkey carts (to haul fencing materials).

K. EXTENSION ACTIVITY AND AGRO-PASTORALISM

Introduction

78. Extension staff attached to the Field Services Division would be responsible for implementation of the interventions and activities described in this annex. Details on extension methodology are given in Annex 2. This section of Annex 3 outlines the use of demonstrations of the interventions which would be promoted by the project's extension staff in the agro-pastoral systems.

Demonstrations

79. The project would provide sufficient resources to effectively disseminate the production methods, techniques, seeds, etc., positively evaluated by the adaptive trials. Some priority interventions, which require only a little further adaptive evaluation, such as strip clearing, strip cropping/pastures and live fencing, would be supported by effective, large-scale extension programmes to disseminate the technology as quickly as possible. The first phase established some demonstrations on farms and this programme would be expanded

and extended. Each grazing degaan would be serviced by a VEW, and each district would have three DEOs each responsible for a third of the district and between 2-5 degaans. In the agro-pastoral areas, each VEW would regularly visit at least 80 local contact agro-pastoralists each month. At least 20 of these would be involved with demonstrations of technology previously evaluated in the adaptive trials. The VEWs, assisted by their supervising DEOs, would advise the demonstration contact agro-pastoralists how to establish demonstrations on part of their enclosure or farm. In this way, agro-pastoralists could compare the results with those from their traditional system and not have to risk their livelihood.

80. Some of the more co-operative and responsive participants would establish on-farm trials to duplicate demonstrations over a range of soil types and social, economic and environmental conditions. The contact agro-pastoralists would be regularly and systematically visited each month by their VEW, often accompanied by the DEO, during which time they would discuss information supplied at their last monthly training session, and other issues concerning development in the agro-pastoral system.

81. Field days would be held so that large numbers of agro-pastoralists could inspect and learn about the interventions. The DEOs and other Agro-pastoral Section staff, including ALFs and the Adaptive Trial Agronomist, would act as resource people to help the extension staff with these activities. A large number of demonstrations would be established in the areas surrounding the Nooleeye and Bula Burti adaptive trials so that these centres became major Training and Education Centres. The district staff would actively encourage RLAs and other community groups to become involved in project activities. They would meet regularly with these groups and provide them with selected inputs (seedlings and tools) and encourage agro-pastoralists to accept responsibility for activities such as village tree planting and shelterbelt development.

64

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

LIVESTOCK PRODUCTION AND ANIMAL HEALTH

LIVESTOCK PRODUCTION AND ANIMAL HEALTHTABLE OF CONTENTS

	<u>Page</u>
A. BACKGROUND TO THE GTZ PROJECT	1
Introduction	1
General Achievements by the GTZ Project	1
Continued Support from GTZ	2
B. SPECIFIC RESULTS FROM THE GTZ PROJECT	3
Livestock Surveys	3
Initial Disease Investigation	4
Preliminary Conclusion	4
Sheep and Goat Productivity	4
C. CRDP-II PROGRAMME	7
Co-operative Programme with ILCA	7
CRDP-II Activities	7

LIVESTOCK PRODUCTION AND ANIMAL HEALTH

A. BACKGROUND TO THE GTZ PROJECT

Introduction

1. The German Government has funded the "GTZ Veterinary Component" of the project. A recent review recommended that funding continue until the end of 1990. The objective of the GTZ project is to improve livestock production and health in the regions of Mudug, Galguduud and Hiran. The GTZ project aimed to achieve this objective within the overall framework of CRDP-I. To meet the specific GTZ project objectives, the activities were:-

- (a) The investigation and quantification of the major disease constraints on livestock productivity within the CRDP-I area.
- (b) The design and implementation of methods to overcome these constraints through the development of appropriate disease control strategies, extension advice and other relevant veterinary inputs.
- (c) The evaluation of the above through testing and monitoring under field conditions to ensure effectiveness, economic viability and relevance to the needs and aspirations of pastoral communities within the project area.
- (d) The in-service training of counterpart staff in appropriate disease investigation methodologies and techniques for the collection and processing of biological samples.
- (e) An investigation of the means whereby suitable veterinary inputs could be delivered, and disease surveillance improved, through testing and then equipping Nomadic Animal Health Assistants (NAHAs).
- (f) The establishment of a revolving drug fund.

General Achievements by the GTZ Project

2. To-date, the GTZ funded component of CRDP-I has completed the following activities:-

- (a) A suitable infrastructure has been established to complete field investigations:-
 - (i) the construction and equipping of a Central Disease Investigation Laboratory at Belet Weyne and two smaller laboratories at Galkayo and Dusa Mareb,
 - (ii) the training of counterpart staff in the appropriate methodologies for carrying out field investigations, and in the collection and laboratory analysis of biological specimens, and
 - (iii) the development of a suitable infrastructure to ensure the efficient management and operation of the project.
- (b) A disease survey designed to investigate disease constraints to livestock productivity has been undertaken in the priority districts of El Dere, Bula Burti and Hobbio, and in the district of Belet

Weyne. Field work was finished by the end of May, 1986, and specimen processing and data analysis should be completed by the end of 1986. The results will establish baseline parameters and indicate major disease constraints, and will help define further research and development priorities. The surveys have also enabled working relationships to be established with pastoralists and have provided the opportunity for installation of a herd and flock monitoring programme through which veterinary inputs designed to improve livestock health and productivity can be developed and tested.

- (c) Meetings have been held with nomads and elders in El Dere district to explain the concepts and operations of the NAHA programme. Suitable individual pastoralists have been recruited and training of NAHAs has commenced. Similar programmes are planned for Hobbio and Bula Burti districts.
- (d) A methodology has been prepared for the operation of the revolving drug fund and the first batch of drugs has been distributed.
- (e) A master mechanic has been posted to CRDP-I's workshop in Mogadishu to establish a facility to service and maintain CRDP-I vehicles, and to train counterpart mechanics.
- (f) A lecturer in forestry and wildlife has been provided to the Afgoi Forestry and Wildlife Training Centre. He has assisted with the development of training programmes in forestry, forestry engineering, botany, livestock production and beekeeping.

Continued Support from GTZ

3. Phase II Activities. A second phase of the GTZ - supported veterinary component of CRDP-I will commence in January, 1987, and run until the end of 1990 (four years). This phase would include the following activities 1/-:

- (a) The continuation of the existing survey and monitoring programme in Hobbio, El Dere, Bula Burti, and Belet Weyne districts.
- (b) The extension of disease surveillance and investigation activities into the Somali-Ethiopian border areas, with particular emphasis on Dusa Mareb and Galkayo districts.
- (c) The expansion and monitoring of the NAHA programme into the other CRDP-II districts.
- (d) The operation of the revolving drug fund.
- (e) The development and expansion of the existing training programme for project counterparts to include the provision of funding for training in foreign countries, as well as in-service training.
- (f) The assignment of a GTZ master mechanic to the field headquarters at Belet Weyne.
- (g) The transfer of the GTZ lecturer at Afgoi from the GTZ veterinary component to the forestry component.

1/ Some of these activities and their associated costs are not related to CRDP-II; available information does not allow any disaggregation.

- (h) Additional support to the Kismayo Veterinary Laboratory through the provision of a vehicle, laboratory equipment, spare parts and supplies.

4. Phase II Personnel and Equipment.

(a) GTZ Personnel and Training:-

Veterinary experts	up to 84 man-months.
Laboratory Technicians	up to 48 man-months.
Master Mechanic	up to 36 man-months.
Short-term experts	up to 6 man-months.
Counterpart training	up to 6 man-months.

(b) GTZ Material Supplies:-

One heavy duty four wheel drive truck.
Five, four wheel drive station wagons.
Spare parts.
Workshop and field equipment.
Laboratory equipment and supplies.

The total value of the contribution by the Federal Public of Germany to CRDP-II's veterinary component would be about US\$2,500,000.

(c) Government of Somalia, Staffing and Budget Contribution:-

Project Leader	48 man-months.
Veterinarians	312 man-months.
Laboratory Technicians	384 man-months.
Drivers	509 man-months.
Mechanics	72 man-months.
Service operators	96 man-months.
Support personnel	712 man-months.
Material supplies	SoSh 12.7 million.
Consumable laboratory supplies	US\$109,000.
Costs: electricity and water supplies to the laboratories, stores, offices and houses.	

As from 1st January, 1986, an increasing proportion of the recurrent costs for the purchase of veterinary drugs through the revolving fund would be provided by the Somali Government. The proportion of costs to be funded by the Somali Government would be 25% in 1986, 50% in 1987, 75% in 1988 and 100% thereafter.

B. SPECIFIC RESULTS FROM THE GTZ PROJECT^{1/}

Livestock Surveys

5. By February, 1986, a total of 172 herds and flocks had been surveyed in CRDP-I's priority districts, and Belet Weyne district. The herds were tested an average of 2.6 times per year and 38% of the herds were revisited regularly at two-month intervals. In total, about 9,000 sheep and goats ^{2/} were sampled regularly from identified sub-samples within herds. Each sample was subjected to a minimum of nine diagnostic tests.

^{1/} This section of the annex has been summarised from "First Livestock and Disease Data for Central Somalia: Outlook and Recommendations", Karl H. Zessin, GTZ, Somalia.

^{2/} GTZ concentrated on these species in recognition of their importance in the project area, and their contribution to livestock exports.

6. The veterinary component employs an innovative epidemiological approach to disease investigation which focuses on the study of all factors which determine the frequency and distribution of disease events in Central Somalia's livestock population.

Initial Disease Investigation

7. Initial disease investigation work concentrated on the diseases with assumed importance, as reflected by:-

- (a) health requirements for exports (brucellosis),
- (b) current mass vaccination programmes (CBPP), and
- (c) priorities in current veterinary drug procurement (tick transmitted haemoparasites).

8. The prevalence of these diseases was screened by a slaughter survey of livestock at the Belet Weyne slaughter house. The prevalence rates for Brucella abortus and B. melitensis are low and meet the sanitary requirements for export. CBPP infection in the local breeds of goats appears to be confined to individual herds and probably spreads within, rather than between herds, because of the policy of herd separation, except for occasional contact at watering points. Parasitological investigation showed the presence of Theileria, Anaplasma and Babesia spp.

9. Reproductive problems in flocks and herds were also investigated. Pre-screening of sera from southern Somalia identified diseases of possible importance in regard to abortion and sterility. Further investigations are required, although the GTZ team has questioned the desirability of increasing reproductive rates when female stock cannot be sold for export and the rangeland is perhaps already stocked to capacity.

Preliminary Conclusion

10. The GTZ team report that the overall status of the goats and sheep in regard to the diseases of assumed importance (brucellosis, CBPP and tick-transmitted haemoparasites) is much better than anticipated at the beginning of their survey. The team stress that this position should be safeguarded by implementing a programme of organised and systematic surveillance and monitoring. It is recommended that the Ministry of Livestock, Forestry and Range should stratify their policy with respect to mass prophylactic and curative measures, because restricted veterinary inputs applied to specific categories of livestock populations would generate higher returns.

Sheep and Goat Productivity

11. Introduction. Animal husbandry was not emphasised in the SAR for CRDP-I. Very little data were available in 1979 relating to herd structures, reproductive rates, growth rates, milk production and mortality. The situation did not start to change until the GTZ veterinary teams began to collect data in 1984, and CRDP-I appointed a Livestock Production Officer (through USAID) in 1985. Therefore, only very limited information on livestock productivity is available, but the situation is improving.

12. The available data indicate that although most livestock owners have all four species (cattle, sheep, goats and camels), proportions vary, depending on production systems. Similarly, the mix of species within a pastoral flock/herd varies, depending on season. Table A4.1 shows the mean biomass for each livestock type in the wet and dry seasons for the seven different production

TABLE A4.1 : LIVESTOCK BIOMASS, WET AND DRY SEASON (kg/km²)

Production System	Cattle		Sheep		Goat		Camels		Total	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Coastal Plain	795	301	424	230	688	558	195	103	2,102	1,192
Agro-pastoral Sands	814	367	385	395	898	1,588	2,213	800	4,310	3,150
Agro-pastoral Clays	148	1,685	546	369	869	801	1,383	1,207	2,946	4,062
Western Shebelle	1,346	1,160	123	96	281	280	4,475	2,277	6,225	3,813
Interior Shrubland	25	261	174	155	1,166	775	1,848	1,082	3,213	2,273
Interior Dwarf Shrub/Grassland	1,613	59	378	144	1,196	517	5,046	374	8,233	1,094
Northern Plateau	2,029	0	325	14	2,029	89	20,417	717	24,800	820

Source: RMR Survey, 1979.

systems in Central Somalia. There are no data on stratification by herd size, although it appears that there are some substantial herds of camels (to 420 head) and some large flocks of sheep and goats (to 3,000 head). Data on productivity are limited, but indicate that an off-take rate for sheep and goats of about 24% could be sustained. The proportion of females in the herds/flocks is high (86% for goats and 78% for sheep) 1/.

13. Herd/Flock Parameters 1/.

- (a) Average size: 192 animals.
- (b) Crude mortality: 26.1%.
- (c) Young stock mortality: 23.7%.
- (d) Adult mortality: 15.17%.
- (e) Fertility rate: 79.4%.
- (f) Lambing/kidding interval: 10.5 months.

14. Only 30% of the young goat mortality is due to disease and parasites; a large number of male goat kids are slaughtered at an early age whenever does fail to produce sufficient milk for their kids, or when kids compete with the demand for milk by the pastoralists' families.

15. Fertility rates and birth intervals are comparable with the parameters reported from other African pastoral systems, and reflect the husbandry systems used by Somali pastoralists. Goat herds are mated continuously, but conception is governed by seasons. Sheep breeding is more controlled and seasonal mating is attempted.

16. Options for Veterinary Inputs. The GTZ team recommended that the present veterinary service should change from a clinical to a surveillance and monitoring approach, in combination with concentrated and directed prophylactic measures. The GTZ team considers that there is potential for Nomadic Animal Health Assistants (NAHAs) or private Veterinarians working under license to the Ministry. The best options for veterinary inputs are reported to be:-

- (a) Safeguard the health of export animals.
- (b) Increase the pastoralists' and agro-pastoralists' potential to supply heavier sale stock (for local consumption and export), through veterinary interventions.
- (c) Evaluation of the potential to improve herd productivity by controlling reproductive disorders 2/.

17. Stratified Deworming. The GTZ team recommended a programme of stratified deworming to achieve a greater number of animals of market weight. This would mean that pastoralists may be able to produce animals in a more direct way for specific sales, particularly when the rainy seasons proceed the Hadj. Improved protein supply during the rainy seasons could be utilised for improved weight gains following deworming. Therefore, if strategic deworming was an integral

1/ Reported by CRDP-I.

2/ This option should be examined closely, given the current status of the rangelands - the GTZ team reported that serum urea levels in goats were below the critical level in the Jilaal (dry), indicating the maximum stocking capacity has been reached, at least in the pure pastoral systems. However, increased and varied fodder production in the agro-pastoral systems may result in increased carrying capacities.

72

part of herd management, pastoralists could produce animals more acceptable to the market place, without increasing herd/flock sizes and placing further pressure on the rangelands.

Figures A4.1 and A4.2 show the average weight and weight gain for goats and sheep drenched in May (just before Gu, the main wet season).

18. Increased Herd Productivity. The GTZ team reported that fertility rates could probably be increased. However, the team cautioned that if fertility levels are increased, the impact and financial viability would have to be monitored carefully. The team noted that there is a non-linear relationship between animal supply and export, and that it is incorrect to assume that a greater number of animals suitable for off-take would automatically result in increased exports and improved financial results. This is because export figures are determined by political and marketing factors, not the number of animals suitable for market. Furthermore, the ban on the export of female stock would make the sale of the additional females produced difficult. Therefore, stocking pressure would increase if reproductive rates are increased.

C. CRDP-II PROGRAMME

Co-operative Programme with ILCA

19. A co-operative programme between ILCA and GTZ's livestock health activities will commence in late 1986. CRDP's livestock husbandry and extension staff will also be involved. This co-operation will be used as an opportunity to commence staff training and to develop techniques for a co-ordinated livestock production programme in CRDP-II.

CRDP-II Activities

20. Introduction. CRDP-II would make use of the rapid herd appraisal/assessment techniques developed by ILCA to survey and assess livestock production and husbandry practices, and to identify constraints. This would build on the results from CRDP-I and closely integrate the livestock health/production work with other components based on the SIMP team approach. Central Somalia has seven different livestock production systems. Differences between the systems are reflected in livestock herding strategies, livestock numbers, herd composition and the contribution from farming. CRDP-II would use a phased approach of investigating a production system for a year (to identify constraints and potential interventions) and then promote interventions with promise in the second year. The interventions identified and partially tested during CRDP-I would be implemented at the commencement of CRDP-II. CRDP-II would appoint an expatriate Livestock Production Officer to direct the livestock production aspects of SIMP and the livestock production investigations, interventions, extension programme production and monitoring. The Livestock Production Officer would take over the technical responsibility from the USAID-funded Livestock Production Adviser, as USAID funding for this position will cease approximately 6 months after CRDP-II commences. He would have a Somali graduate counterpart assistant (the Senior Livestock Production Officer). Together, they would work with the SIMP team members to undertake surveys, etc., and then direct the livestock production aspects of the development programme. Further details on the livestock production activities within SIMP are given in Annex 1. The development programme would be undertaken in the districts by the graduate Extension Officers (DEOs) who would have received at least two years experience in livestock husbandry and health while working with the SIMP teams.

FIGURE A4.1 : AVERAGE WEIGHTS AND WEIGHT GAINS AFTER WORM DRENCHING (↑) OF SHEEP IN CENTRAL SOMALIA, 1984-1985.

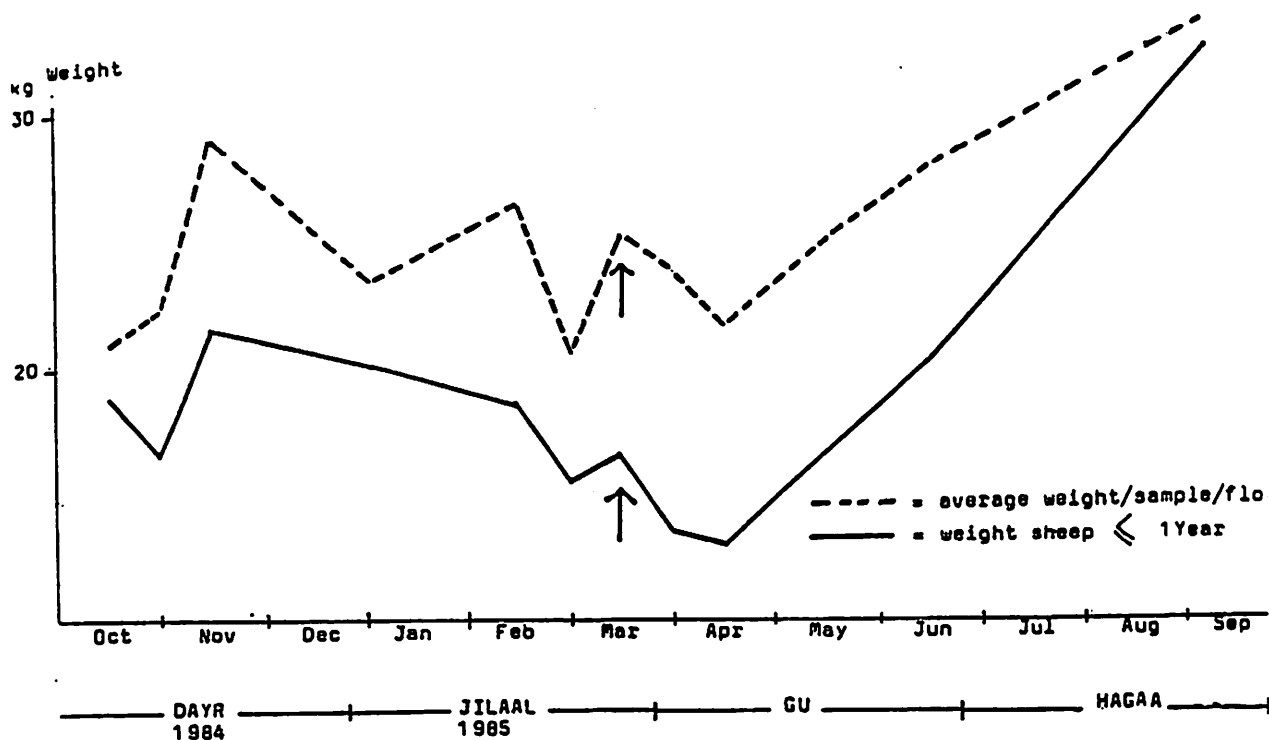
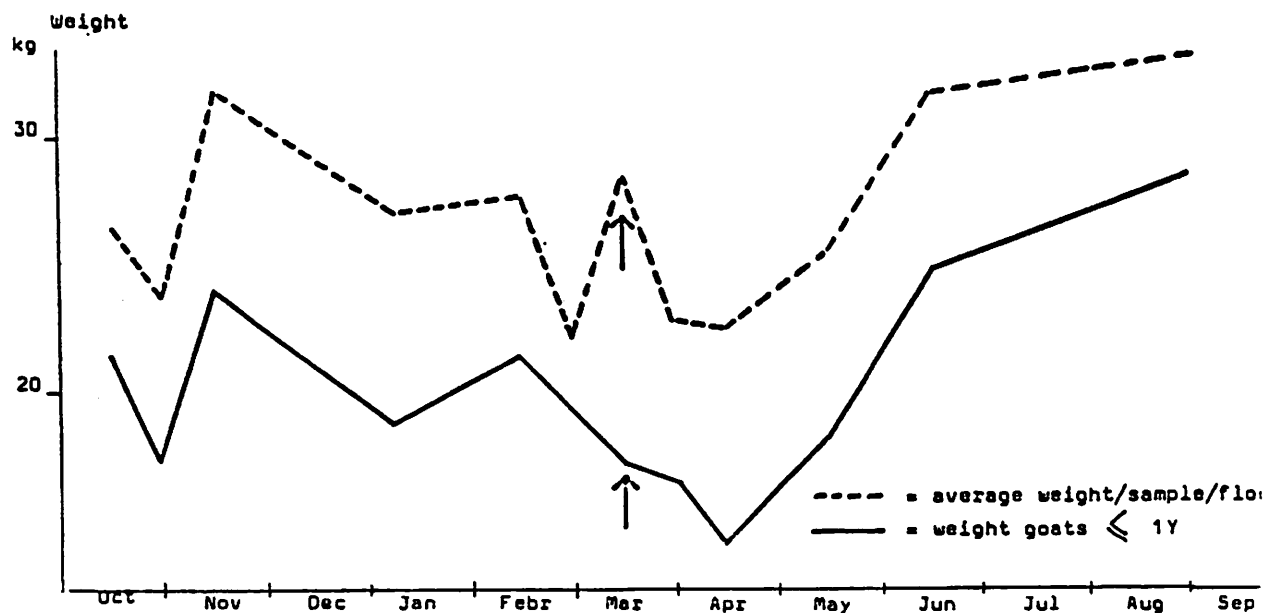


FIGURE A4.2 : AVERAGE WEIGHTS AND WEIGHT GAINS AFTER WORM DRENCHING (↑) OF GOATS IN CENTRAL SOMALIA, 1984-1985.



Source: Karl. H. Zessin, GTZ, 1986.

74

21. CRDP-II would fund the present GTZ veterinary activities after January, 1990. This would cover operating costs for two Somali Veterinarians and their support staff to continue regular systematic field monitoring and NAHA support throughout Central Somalia. The project would also fund the operational/maintenance costs of the veterinary laboratories established by GTZ in CRDP-I.

22. GTZ's livestock veterinary activities in CRDP-I, livestock production and extension and the proposed input by ILCA would be co-ordinated and integrated, and provide support for CRDP-II. A PPF would finance a programme for ILCA to train staff from all CRDP-II components. ILCA would also assist with the refining of suitable techniques and the commencement of long-term monitoring of sample livestock herds. The trained staff, techniques and sample herds would all provide a basis for further activities in CRDP-II.

23. Management Interventions. Although livestock management interventions would arise from, and be implemented following, the SIMP and pre-development studies, CRDP-I found that certain interventions had good public acceptance. Therefore, rather than delay all interventions, simple and proven technology would be initiated during the SIMP and pre-development studies. Visible and popular development activities also have a role in gaining support and co-operation from the local communities and officials. The NAHA programme is an example of such an intervention.

24. General Livestock and Health Programme. The livestock health component has concentrated on determining the health status in Central Somalia, and identifying ways in which it can be improved. Two veterinary field teams each spend 10 days per month monitoring sample herds and treating local livestock. They also monitor the impact of interventions, such as internal parasite control. Results are disseminated through training, supervision and the provision of drugs and equipment to local DVOs and to the RLA's NAHA programme. A surveillance programme has been established to monitor any outbreak of serious livestock diseases.

25. The livestock health programme has been supported by the three veterinary laboratories established during the first phase at the Regional Centres of Galkayo, Dusa Mareb and Belet Weyne. Because of the critical importance of livestock health issues to the Somali economy, particularly in regard to the export of livestock, the project would take over the support of this component at the beginning of 1991 when GTZ funding ceases. If possible, the NAHA programme would be extended throughout Central Somalia.

26. Nomadic Animal Health Assistants (NAHAs). Each RLA would nominate a minimum of four RLA delegates to be NAHAs in consultation with local extension staff. Initial and regular refresher/supplementary training courses would be organised for the NAHAs by the livestock health team, with support from the Extension Section. The performance of the NAHAs would be reviewed annually by the RLAs. The NAHAs would be re-elected every two years by the RLAs, with preference given to RLA members who are traditional livestock health specialists.

27. The livestock health team would distribute proven drugs, on a revolving fund basis, to the RLAs and DVOs and, in areas without RLAs, to acceptable alternative pastoral organisations. The current supply of veterinary drugs is inadequate. By training many pastoralists (NAHAs) in simple diagnostic and treatment techniques and providing adequate suitable drugs, an acceptable livestock health programme would be established.

28. The NAHA system, including the provision of drugs on a revolving fund basis, would be extended to all RLAs which are able and willing to accept the use of veterinary treatments to increase livestock production. This programme would be completed in Bula Burti, Ceel Dheer and Hobbio in 1987. It would then be extended to Dusa Mareb and Galkayo districts. If successful, a similar programme would be extended to the other CRDP-II districts.

29. The NAHA system would also form an essential part of a basic surveillance system which monitors threatening and important diseases. This programme would be established over the next four years within the Ministry of Livestock, Forestry and Range.

30. Livestock Husbandry and Production Interventions. The promotion of livestock husbandry production interventions would commence once the SIMP studies are completed and have identified suitable and acceptable interventions. The district extension staff would then identify contact agro-pastoralists wishing to improve livestock production. The DEOs and VEWs would then regularly visit the contact demonstration herds to give technical advice based on SIMP and livestock production investigations. The Extension Section would support the dissemination of promising interventions through the use of demonstrations, bush schools/workshops, seminars, meetings and the use of audiovisual aids and radio.

31. The main proven intervention to support the project would be the use of strategic deworming programmes to improve weight gains of sheep and goats. Details are given in Section B of this annex.

32. Other Options. The potential for using livestock traction would be evaluated and promoted during CRDP-II. Camels are rarely used for riding, or any form of work (except carrying loads) in Central Somalia. Even donkey carts are not common and cattle are not used for traction. Preliminary investigations indicate that there are no strong social, cultural or economic reasons preventing greater use of animals for traction. Given the close relationship of nomadic pastoralists with their animals (particularly camels) and the natural resistance and conservativeness of a subsistence society to change, it would be expected that this programme would need to rely greatly on practical demonstrations and be long-term in nature.

33. Camel Riding. One of the greatest needs in Central Somalia is for transport. Vehicles and fuel require scarce foreign exchange. Camels are ideal for riding and carrying loads in remote dry areas, such as Central Somalia. This is proven by their extensive use in countries such as Sudan, India and Pakistan and, in the past, Northern Somalia. Somalia has the largest population of camels in the world and while most are smaller than many other types of camels, they are apparently still suitable for riding.

34. The project would provide a consultant Camel Riding and Training Expert for three months. The consultant would supply a set of saddles and bridles. Initially, eight suitable riding camels and eight burden camels would be purchased by the Riding Consultant and the livestock husbandry team for training. Using the Aborey Demonstration Centre as a base, the consultant would train eight grazing reserve guards and eight livestock husbandry, socio-economic and extension staff members to ride and care for camels. One riding camel and one burden camel would subsequently be used for transport by four of the grazing reserve guards to patrol the boundaries of a shrubland grazing reserve. The other four sets would be used by the SIMP team to follow herds during intensive investigations and by district extension staff for transport. Each person using a camel would receive SoSh 3,416 per month to look after and maintain their camel.

35. If camel riding is accepted by the project's staff as a suitable and efficient form of transport, the decreased cost of vehicle operation would offset the cost of buying and caring for additional camels. Therefore, the project has not made provision for the purchase of extra riding and burden camels if camel riding proves to be an efficient means of transport for the District Extension Officers. The project management unit would evaluate the camel riding programme six months after the consultant had completed his assignment and would establish a policy for further purchases. In the event of acceptance, the staff trained by the camel riding consultant would train further teams of guards and extension personnel.

36. Draft Animals. CRDP-I demonstrated the success and appropriateness of using Commiphora shrub species to make live fences. The lack of bushes to provide fencing material near watering points and villages was identified as a major factor contributing to desertification in agro-pastoral areas. While the use of live fencing would be promoted in CRDP-II, the difficulty of fencing near water points would remain a constraint, unless appropriate transport is available. Individuals would be encouraged to transport fencing materials through the provision of half the estimated cost of two camels and two donkey carts in each of the two agro-pastoral production systems. The carts or sledges would be designed to carry large quantities of relatively light Commiphora branches.

37. With the adoption of strip cropping techniques to reduce erosion and improve the agro-pastoral production systems, the use of animals to draw cultivation implements becomes possible. The Agro-pastoral Section would liaise closely with the Bay Region Agricultural Development Project and ILCA to examine the feasibility of introducing draft animals for cultivation purposes. Suitable implements and harnesses would be made locally. A consultancy of one month would give the agro-pastoral staff and interested agro-pastoralists training in using camels, donkeys or cattle for cultivating/weeding/farming. Draft animals and implements for two agro-pastoral adaptive trials would be purchased by the project. Their use would be evaluated on the trial and demonstration sites, and the technique disseminated through demonstrations and field days if successful.

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

WATER DEVELOPMENT

WATER DEVELOPMENT

TABLE OF CONTENTS

	<u>Page</u>
A. CRDP-I WATER DEVELOPMENT	1
Bores	1
Dugouts	1
Wells	1
Gabion Dams	1
Berkeds	1
Other Developments	1
Cost of Bores	2
Additional Bores	2
Cost of Dugouts	2
Water Costs and Operations	2
Windmills	3
B. THE PROJECT	3
Operation of Boreholes	4
Dugout Maintenance	5
Benefits from Water Development	6
Issues	6
FIGURE A5.1 : Map of Central Somalia Showing Location of Areas More Than 20 km From a Water Source	7

WATER DEVELOPMENT

A. CRDP-I WATER DEVELOPMENT

Bores

1. In the SAR for CRDP-I it is stated "in general, however, all bores, with minor adjustments, should produce good water" Unfortunately, this was not the case. To-date, 20 boreholes have been drilled (of an expected 32), have been fitted with diesel driven pumps (but civil works have not been completed), three have hand pumps (all of which have failed), ten were dry holes, and two yielded salty water.

Dugouts

2. Twenty dugouts (unlined earth excavations) have been constructed in the three priority districts. The unit capacity averages about 2,700 m³. Due to the sandy nature of the majority of the soils, dugouts do not provide a permanent water supply and this helps to prevent overgrazing in their vicinity. In low rainfall seasons some dugouts do not fill, in other circumstances some dugouts fill twice in a year (with both seasons).

Wells

3. Sixteen wells have been rehabilitated in the three priority districts. The top of each well has been recast, using masonry, to a height of 1.0 m above ground level and an outward sloping concrete plinth has been constructed. A basin has been formed around the top of the well and pipes lead water to drinking troughs 20 m away. The well improvements are highly regarded by local people.

Gabion Dams

4. Three gabion dams were constructed in Hobbio district in phase I. One collapsed, another failed to hold water and the third diverted water as planned.

Berkeds

5. Throughout the project area householders and villagers have constructed cement rendered, rock lined, vertical sided earthen water storage tanks (berkeds), mainly for use by the human population and a few village-associated small stock. The only berkeds constructed during phase I were at project nurseries.

Other Developments

6. The Saudi Arabian Programme for Rural Water Supplies (SAPRWS) has drilled 21 boreholes in the CRDP area, mainly within 400 m of existing boreholes which had fallen into disrepair. This was done with little liaison between NRA/CRDP and SAPRWS. Article VI of the Rangelands Development and Management Act gives NRA the responsibility of issuing permits for any water points in a rangeland area, but excludes urban supplies. Despite the fact that the SAPRWS boreholes are primarily for human supply, in small communities it is likely that a high proportion of the water will be used for livestock. An "over-supply" of water may attract sufficient stock numbers to have a deleterious effect on surrounding areas. The regulations should be clarified or amended to avoid any possible repetition of drilling in the CRDP area without NRA approval.

Cost of Bores

7. The average cost of drilling the 20 CRDP bores was about SoSh 17.75 million each and, given the poor success rate, the cost of each production hole was in effect SoSh 27.20 million. Commercial contractors charged between SoSh 5.1 million and SoSh 7.65 million for drilled and equipped bores in the same period. If they had experienced (and charged for) a success rate similar to CRDP's, their charge per production hole would have been about SoSh 12.75 million (after allowances for dry holes).

8. CRDP owns about SoSh 42.50 million worth of machinery and well drilling equipment supplied in conjunction with the CRDP-associated USAID Comprehensive Ground Water Development Project which, with the Water Development Authority (WDA) of the Ministry of Mineral and Water Resources, drilled boreholes in the project area and in the Bay Region. This project is now finished. Drilling requirements in CRDP-II would not be extensive and it is recommended that the project brings back into its regular operations any suitable equipment and vehicles, and that the balance, including the rigs, be sold to WDA or private contractors.

Additional Bores

9. Two boreholes, one in Jariban district and one in Haradhere district at the village of Deegan have been approved by CRDP and will be completed before the start of phase II.

Cost of Dugouts^{1/}

10. The average dugouts cost about SoSh 382,000 to construct in phase I (SoSh 142/m³) (CRDP). Three have been equipped with comprehensively engineered drop inlets to counter severe inlet erosion. These were significantly more expensive (about SoSh 340/m³).

Water Costs and Operations

11. On completion, CRDP-I boreholes have been handed over to WDA for operation and maintenance (civil works have not been completed). WDA supplies an operator, a limited quantity of fuel and some spare parts. The official cost for water at a borehole is SoSh 10/m³. However, because of the erratic supply of fuel from WDA, the operator often has to purchase diesel on the open market and then recoup his expenses by raising the charges for water by 3-5 times.

12. The situation in relation to maintenance is not good. CRDP bores and engines are still fairly new and should operate without problems (even if minimally maintained) for some time. However, WDA has responsibility for other bores in the project area and not all are operating well. For example, in August, 1986, the bore at Wisil had been pumping sand for some considerable time, output was down, and no regular maintenance was forthcoming. WDA is short of vehicles, spare parts, equipment, fuel and other items essential to operate an effective water supply service. The technical merits of equipping these remotely located bores with high speed diesel engines and rotary pumps might be questioned. Slower speed diesel engines and reciprocating pumps might have advantages.

13. Water from dugouts is generally free to users. Because of the nature of the construction, the general soil types and the desire of the livestock owners to either water their animals direct from the water's edge, or from small

^{1/} These costs do not include a charge for amortising the capital investment.

thornbush pens close to the water, siltation is a constant problem. To-date, dugout users have shown little interest in the management of the facilities. This is an area where RLAs might become more involved. In the longer-run, neither NRA (CRDP) nor Government can be expected to continue to maintain dugouts free of charge. Dugout maintenance using bulldozers is expensive. Techniques have been developed by ILCA in Ethiopia for dugout desilting (and construction) using animal traction and scoops. This system may be applicable to the project area.

Windmills

14. Windmills have been used in Somalia since 1927. Almost constant winds, seldom falling below three metres/second, even far inland, make this method of pumping water potentially attractive. No windmills were erected by CRDP in phase I, partly, it is understood, because of the very high level of maintenance required. However, modern windmills produced in a number of countries, including Kenya, are competitively priced compared with engine-driven pumps, have lower operating costs, and should be well suited to selective uses in Somalia. The maintenance requirements of these windmills are also lower than earlier models.

B. THE PROJECT

15. The project would provide for up to 10 boreholes to be drilled and equipped in phase II. Borehole development would be dependent on the results of pre-development surveys, and boreholes would only be constructed in response to the needs of local people, and in circumstances where the impact on vegetation in the surrounding area would not result in range degradation. In the event that 10 suitable and required sites were not located, the unexpended portion of the funds would, subject to discussions between CRDP and the donors, be transferred to another component.

16. With experience from phase I, it is anticipated that a borehole success rate of around 75% would be achieved. Particular attention would be given to ensure that, where necessary, correctly sized screens were used (wound or punched) with gravel packing as appropriate. Boreholes would normally be equipped with diesel engines, but, where water supplies were limited, windmills would be provided.

who to build dugouts + how?

17. The project would, in consultation with local elders, and after examination by a team of project staff, select a total of 70 dugout sites. Dugouts would typically be from 2,500-3,500 m³ in volume and would retain water for from 2-6 months. An undertaking by the local people to accept responsibility for dugout operation and maintenance would be a pre-requisite to dugout construction. The fencing of dugouts, whilst theoretically desirable, would only be considered if users showed indications of being willing to respect the fences. In the early years, at least, this may not be the case.

18. The project would install windmills at district headquarters at Bula Burti, Ceel Buur, Dusa Mareb, Galkayo, Haradhere and at Hobbio, if good water is found. These windmills would be used as demonstrations. A further 27 windmills would be provided at suitable water sources in each district, probably on both wells and low-yielding bores, and mainly within the jurisdiction of RLAs who would be encouraged to purchase the windmill, operate and maintain it, and sell the water. Extended purchase terms would be available. Windmill pumps would be carefully matched to the size of mills and the required purposes. Both syphon and double acting barrel pumps would be available. CRDP would stimulate local private contractors to erect and service windmills by:-

- (a) Issuing public competitive tenders for erection and maintenance. Contracts would be issued in small packages to give several contractors some experience and to develop competition.
- (b) Providing a short-term consultant to train contractor staff in erection and maintenance. This training would be made a condition of the supply of windmills. No additional cost to the project would be anticipated.
- (c) Initially, the project would provide spares to contractors on a cost recovery basis.

19. During phase II, the project would support the rehabilitation of 28 wells (up to 100% of costs), and a further 28 (50% of costs). In addition, the project would assist with the construction of 28 new wells by providing, on loan, but at no charge, the necessary tools and equipment.

20. The project would appoint a dugout maintenance team. It would clean out (desilt) dugouts using camel-drawn scoops designed by ILCA but produced in Somalia. Three sets of scoops with harnesses would be made. The camels and equipment would act as a demonstration. They would be phased out after two years.

21. The project would provide up to six RLAs with half the cost of building a pulley system and purchasing a camel to demonstrate the use of this system for drawing water from deep wells. This system, whilst used in Southern Somalia, is unknown in the project area.

Operation of Boreholes

22. Following discussions between WDA and NRA it has been agreed that, until the end of CRDP-II, the operation and maintenance of all CRDP boreholes (phases I and II) would be controlled by the project which would collect all revenue. Phase I boreholes (seven equipped with diesel engines - five to-date plus two before the end of phase I, and all with completed civil works) would become the responsibility of CRDP at the commencement of phase II. Phase II boreholes would be passed to CRDP, with all civil works completed, by the contractor following acceptance by CRDP. To achieve the level of routine maintenance and fuel supplies essential to provide a regular, reliable service, the project would establish a borehole maintenance unit. Manned by three engineers/mechanics, (allowing for holidays), the team would visit each borehole each month and carry out routine servicing. Fuel would be distributed by routine tank/truck visits to other project facilities. Where RLAs were formed they would be encouraged to assume full responsibility for the daily operation of the boreholes. Some RLAs might wish to levy water users to raise funds for community purposes. Water would be sold (refer para 24). Local Government Officers operating in accordance with procedures laid down by the Manager, Finance and Administrative Division (CRDP), would collect the money on a regular, but not completely routine, basis for forwarding to headquarters. Failure to collect money in accordance with the agreed schedule would ultimately result in fuel supplies being cut-off. Conversely, the failure of CRDP to maintain regular fuel supplies would result in a breakdown in the system. Project two-way radio would be used by district staff in the event of emergencies. Each bore would be in the daily charge of an operator who would be paid by the RLA, CRDP, or local people. The system of payment would be reflected in the division of water receipts. The operator would be responsible for daily operations, but would be discouraged from attempting any repairs. Major overhauls, drawing the pump column, etc., would be carried out by contractors on a local tender basis.

23. The arrangement outlined above would not be ideal. It would result in two organisations being responsible for borehole maintenance (and water sales) in the project area; CRDP and WDA. At the completion of phase II it would probably be inappropriate for NRA to continue the maintenance. However, for the present, given the low capacity of WDA, it is a practical solution. The alternative of payments by CRDP to WDA for bore maintenance would probably not be monitorable or effective. It is possible that, having regard to the importance of maintaining water supplies in the project area, a donor might, during the project period, provide funds to strengthen WDA and create a self-financing, permanent maintenance capacity. In this event, CRDP would pass the boreholes to the new organisation and employ the allocated funds and facilities elsewhere, following discussion with the donors for CRDP-II.

24. Estimated investment costs are shown in Table A7.21 and Table A7.22 shows the operating costs associated with boreholes. As expected, the SoSh 10/m³ charged by WDA is insufficient to cover costs. Clearly, given the overall economic situation in Somalia, any Government Department charged with operating a service industry at a loss will have continuing cash problems. Project-provided pumped water would be sold for SoSh 36/m³ as soon as the maintenance system was installed. This figure is 3½ times above the Government charge when fuel is available, but is 30% or more below the charge when fuel is purchased on the open market. Performance under the existing situation is unreliable. Water prices would need to be reviewed at least annually and the capacity of CRDP to charge an economic price (despite WDA charging less elsewhere) would require formal and perhaps legal endorsement.

25. The flow of receipts from water sales could fund some of the cost of water development. However, delays in setting-up the revenue collection system may occur, and legal issues relating to the capacity of the project to sell water, either directly or through RLAs, may arise. To take a conservative approach and safeguard the introduction of a maintenance system, investment and all recurrent costs for the project period are included in the project cost.

Dugout Maintenance

26. A high maintenance requirement is virtually inevitable for all dugouts built in silty or fine sand/clay soils. Low maintenance dugouts are almost always sited on high clay content soils. Many phase I dugouts were of the former type. Later phase I and most phase II dugouts would be sited wherever possible on clay soils.

27. The removal of silt is the main maintenance requirement. In some soils extensive erosion of the dugout walls occurs and scouring of the inlet may be a major problem. Phase II would endeavour not to excavate dugouts on unstable soils. The construction of cement drop chute inlets is not an economic option.

28. Outside Somalia, dugout siltation is also a problem and the solutions vary from hand carrying silt in baskets to the use of heavy earthmoving equipment. In Ethiopia, an interesting innovation has been developed by ILCA. This method uses small, simply constructed metal scoops, guided by an operator using two handles and pulled by one or two animals.

29. In Somalia, only heavy earthmoving equipment is generally used at present. This will become increasingly difficult to support. However, the animal scoop does appear to have promise and the project would arrange for the importation of a sample scoop and the construction of others in Somalia. A consultant would be engaged to train dugout scoop demonstration operators as a team, which would operate across the project area for two years. This system of

desilting should be effective, but must be demonstrated before pastoralists can be expected to show any interest in it. Some problems remain. The majority of dugouts are relatively isolated and cannot be desilted by animal scoops whilst still containing water. However, when they have dried out, the water users (pastoralists) have moved away and water for animals pulling the scoops may not be readily available. A similar, but reverse, situation occurs at the start of the season. The demonstrations would need to be well organised, they would be on a limited scale and seek to identify practical ways of solving the constraints. Close contact would be maintained with RLAs (or other organisations) which negotiated the initial construction of the dugout.

30. Ideally, the users (RLAs) would organise themselves to carry out the desilting, perhaps using scoops loaned by CRDP, or purchased scoops, or alternatively, a contract service could be developed. When the technology has been demonstrated, proven and accepted, it would be appropriate to devise, in conjunction with the dugout users, the preferred maintenance option. The underlying aim would be that the user pays. However, charging for water used on an animal-by-animal basis may not be practical and the options would be carefully discussed with the pastoralists using each dugout. A variety of solutions would probably emerge.

Benefits From Water Development

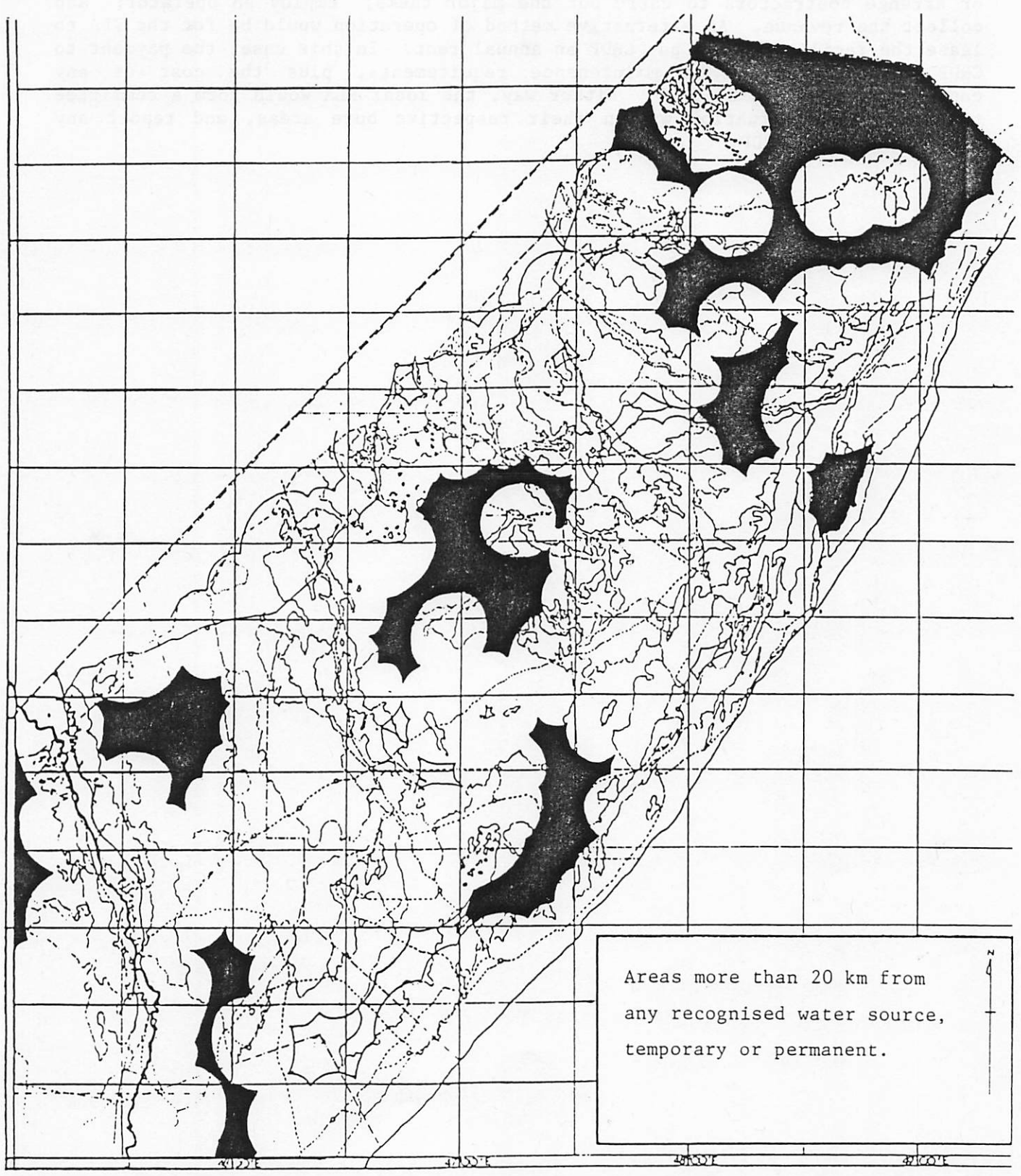
31. The project would, through the provision of additional dugouts and bores, enable the consumption by livestock of presently unutilised forage. The incremental quantity of forage which would be consumed would depend on the specific types of water improvements, their individual location, and the spatial relationship of the incremental water supplies relative to the pre-project situation. The sites would be chosen by the SIMP teams and would be further verified by the Project Ecologist/Range Manager, and then be discussed (and accepted) by the local RLAs or communities. Their exact number and location cannot be pre-determined.

32. For the purpose of quantification of potential benefits, it is estimated that CRDP-II would create the equivalent of 25-27 year-round water points, each servicing about 300 sq km. They would comprise about 80 sites, of which 10 (the bores) would be 12 month supplies and 70 (the dugouts) would function for perhaps 3-4 months/year having regard to drought and constraints of run-off, percolation and evaporation. On this basis, the project-provided water would provide access to some 8,100 sq km, or about 30% of the present area without water supplies (temporary or permanent) (Figure A5.1). It is not possible to predict accurately the degree to which this additional forage would provide incremental grazing and the degree of substitution. Having regard to the temporary nature of dugout water and the lack of knowledge of spatial distribution of the new water sources, it is estimated that the additional forage used would be equivalent to the annual production from about 2,000-3,000 sq km, and would result in an increase in the project area's livestock population by about 1.6% by about project year 7.

Issues

33. The introduction of cost recovery mechanisms is in accord with Government policy. However, NRA has not, within CRDP-I, organised any activity of this magnitude on the "user pays" principle. Difficulties would arise if CRDP did not receive the funds and/or was unable to supply the fuel or continue the repairs. To become effective, the borehole maintenance unit would need to accumulate a reserve of funds to meet future major maintenance requirements. These funds must not be dissipated. NRA has some experience of revenue collection arrangements through its involvement with the Water Reservoir

FIGURE A5.1 : MAP OF CENTRAL SOMALIA SHOWING LOCATION OF AREAS MORE THAN 20 KM FROM A WATER SOURCE



Source: Central Rangelands Survey (RMR 1979) modified by CRDP

Project, and CRDP would take this into consideration when designing detailed operating procedures.

34. The foregoing is based on the premise that CRDP would maintain the bores, or arrange contractors to carry out the major tasks; employ an operator; and collect the revenue. An alternative method of operation would be for the RLA to lease the facility and to pay CRDP an annual rent. In this case, the payment to CRDP would be based on maintenance requirements, plus the cost of any consumables provided by CRDP. Either way, the local RLA would form a committee to monitor the situation within their respective bore areas, and report any discrepancies to CRDP.

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

INSTITUTIONAL ARRANGEMENTS

INSTITUTIONAL ARRANGEMENTSTABLE OF CONTENTS

	<u>Page</u>
A. BACKGROUND	1
National Range Agency	1
Other Agencies	1
B. CRDP-I	1
C. CRDP-II	2
Project Steering Committee	2
Project Management Unit	3
CRDP/NRA Linkages	3
The Divisions	3
Organisation	5

INSTITUTIONAL ARRANGEMENTS

A. BACKGROUND

National Range Agency

1. The National Range Agency (NRA) is a parastatal agency reporting directly to the Ministry for Livestock, Forestry and Range (MLFR). NRA is responsible for all aspects of range management, forestry conservation and forestry development. NRA comprises eight functional departments operating through sixteen regional offices. The eight departments are: Administration and Finance; Forestry with Anti-Desertification; Range and Environment; Wildlife; Planning, Training and Research; Personnel; World Food Programme; Transport and Marketing. In addition to exercising its own day-to-day responsibilities, NRA controls a number of projects, including CRDP.

2. CRDP-I strengthened NRA by providing a new headquarters building, technical assistance, vehicles, equipment and training facilities, as well as a network of ten district office complexes. Economic constraints have, however, reduced the financial allocations which NRA receives from the Government of Somalia (GOS). In 1983, 1984 and 1985, the allocations were SoSh 68m, 38m and 24m respectively. As NRA's staff (excluding CRDP) number 2,053, it is clear that salaries are low and operational budgets severely constrained.

Other Agencies

3. The Ministry of Local Government and Rural Development has delegated substantial powers to Regional Development Committees in relation to social or economic activities in the public interest including soil, water, range and wildlife development. Development of water resources in Somalia is the responsibility of the autonomous Water Development Authority (WDA). Statutory powers have been delegated to regional and village authorities and to NRA. WDA tends to confine its role to the development and operation of boreholes. Some overlap of functions occurs with NRA/CRDP (refer Annex 5).

B. CRDP-I

4. CRDP-I was designed to develop the Central Rangelands and strengthen NRA. At project inception, NRA was designated the executing agency and the General Manager appointed Project Manager. He was assisted by a Project Co-ordinator with a Co-Manager, and implementation of NRA's activities and CRDP's programme was undertaken through the existing NRA structure, with various Departmental Directors assisted by expatriate specialists. This system did not work effectively. The General Manager (Project Manager) became overloaded, the chain of command was confused, and the impact of the expatriate specialists weakened. Security problems and delays in some donor funding further exacerbated the problem.

5. In 1984, a mid-term review was held and attended by GOS/NRA and the donors. This resulted in the administrative and technical separation of CRDP from NRA, although NRA was still ultimately responsible for the project. The main changes were the appointment of a full-time Project Manager reporting to the General Manager of NRA; the concentration of project activities in three districts, Bula Burti, El Dere and Hobbio; the establishment of a Steering Committee composed of representatives of the donors and appropriate institutions in GOS; and the appointment of an expatriate Field Manager to assist with project implementation.

6. The veterinary component, originally proposed for funding by the Overseas Development Ministry (UK), was taken over by GTZ under a direct agreement with MLFR, and the forestry component, also funded by GTZ, was renamed the GOS-GTZ/NRA Forestry Project. Both remained outside CRDP.

7. Despite the difficulties outlined above, there has been some progress in strengthening NRA's implementation capacity (through CRDP). Phase I counterparts include a present Regional Director and three District Range Officers. CRDP staff at headquarters and in the field are keen and enthusiastic and the foundations are laid for the emergence, during the second phase, of a cadre of capable technical specialists and managers. Maintaining the interest of these staff in CRDP and sustaining the morale of all CRDP staff will not be easy. Wages for public officers in Somalia are not centrally co-ordinated and are below the level required to support reasonable living standards, let alone to provide an adequate incentive. For example, depending on the grade, a graduate would receive around US\$25-30 per month. In phase I, CRDP attempted to alleviate this position on a selective basis with housing, and responsibility, technical and hardship allowances, and per diems.

8. At appraisal, the World Food Programme (WFP) was expected to provide food valued at US\$4.3 million over the six year project life. The WFP food was supplied under project number 719 Exp2 and the requirements were to be supplied to NRA for rangeland and forestry development in the whole of Somalia, including CRDP. Food supplies were always late and frequently failed to arrive. Not surprisingly, the absence of regular food deliveries resulted in low work output from an unco-operative and recalcitrant labour force.

9. Overall management of phase I of the project was made more difficult by multi-donor funding. The credit effectiveness date for IDA, IFAD, WFP and GOS was June, 1980. USAID inputs were not effective until early in 1982 and GTZ inputs commenced in November, 1982. Subsequently, donor activities were difficult to co-ordinate and created an additional load on project management.

C. CRDP-II

10. Phase II of CRDP would be implemented over a six year period by NRA, utilising CRDP-I's organisation amended as a result of past experience and having regard to the new responsibilities envisaged. For phase II, the Chief Executive would be the Project Manager. Functionally, CRDP would be organised into four divisions, viz. Technical Services, Field Services, Mechanical Services and Finance and Administration. The Head of each division would report to the Project Manager. All other staff would report through their respective Divisional Heads (refer Figure A6.1).

11. During the first six months of 1988, which might coincide with project commencement, the USAID technical assistance staff (extended from phase I), would be finalising their inputs, whilst possibly overlapping chronologically with phase II. On an organisational basis these staff should be considered as phase I. The GTZ animal health component would be run within the MLFR, but independent of CRDP until 1990, when CRDP would take over. The forestry component of CRDP-I has been renamed GOS-GTZ/NRA Forestry Project, and is currently outside CRDP. Future plans for the forestry activities have not been finalised but might be available at appraisal.

Project Steering Committee (PSC)

12. The overall management of CRDP-II would be demanding and the load on the Project Manager would be heavy. He would have to find ways of delegating

responsibility and means of obtaining support. The design of CRDP-II would include a Project Steering Committee (PSC) which would act in much the same way as a Board of Directors. The PSC would be responsible for all policy decisions in CRDP. It would meet twice yearly to review and approve project plans and evaluate progress, co-ordinate donor activities, and discuss and resolve major issues. The Chairman of the PSC would be the General Manager of NRA, the Executive Secretary would be the Project Manager of CRDP, members would comprise representatives of the donors, representatives of the Ministries of Planning, Finance and Agriculture, the Chief Technical Manager, CRDP, and the Manager of Finance and Administration, CRDP. The PSC would, when appropriate, invite other parties to discuss particular matters. Prior to each PSC meeting, CRDP would organise an appropriate field tour for Committee members. The objective would be to examine in some detail a particular aspect of project activities or constraints, not necessarily to attempt a complete overview.

Project Management Unit (PMU)

13. On a day-to-day basis the Project Manager would need a formal arrangement for support from senior staff. This would be achieved through a PMU, which would meet weekly. The Chairman would be the Project Manager, the Vice Chairman would be the Chief Technical Manager, members would be the Manager, Finance and Administration; the Head of Field Services; the Chief of Extension Services; and three senior Somali technical staff. This Committee would be advisory in nature. It would provide a ready forum for discussion, particularly relating to the implementation of the annual work plans. It would provide the Project Manager with a formal weekly check on details. The meetings would not necessarily, or normally, be lengthy, but would be held as a matter of routine. The tendency to cancel meetings because the agenda appeared to be small would be overcome. Regularity of these meetings would be valuable to overall management and would improve the day-to-day management situation.

14. Underlying the organisational arrangements for phase II would be the need to provide as many Somali staff as possible with experience in the technical, financial and managerial aspects of the project. This would be partially achieved by both organised and informal training. In addition, exposure of selected Somali staff to the detailed requirements for project management would be an essential part of their training. This would be achieved through participation at all appropriate levels of project management, up to and including the PMU.

CRDP/NRA Linkages

15. There is a need for a better understanding of CRDP's activities and operations by NRA and NRA's senior staff (non-CRDP). Therefore, CRDP-II would hold quarterly management meetings with NRA's Director and Division Heads within CRDP. The General Manager of NRA or the CRDP Project Manager would chair these meetings which would review project performance and activities and discuss the quarterly reports prepared by the project's evaluation unit. These meetings would encourage dialogue between NRA and CRDP-II and make sure that NRA's senior staff are aware of CRDP's progress, problems and achievements.

The Divisions

16. The four divisions would be closely integrated. However, the duties and responsibilities of each would be separate and clearly defined.

17. Technical Services Division. The Division would combine under the Chief Technical Manager, most of the technical aspects of the project. These would include Range Management, Livestock Production, Socio-Economics, Data Analysis and SIMP.

18. The Chief Technical Manager would be responsible for the execution of all the Division's activities. None of the Division's staff would report directly to the Project Manager, all would report through the Chief Technical Manager. The Division would be organised into four sections; Range Management, Livestock Production, Socio-Economics and Development Systems. However, whilst these groupings would ease day-to-day management, they would not be autonomous. The whole thrust of the Division's activities would be on a systems approach, utilising multi-disciplinary teams. All Section Heads, the Development System Analyst, Socio-Economic and Rural Development Officer, Range Manager, and Livestock Production Officer would have at least two senior Somali graduates working with them as Technical Assistants, not as Administrative Assistants. These senior officers would, at the completion of phase II, or the departure of the Section Heads, take over their respective sections.

19. The Technical Services Division would also include CRDP's Document Centre and Herbarium, which would continue to be supported as in phase I.

20. Field Services Division. This Division would, through the Head, Field Services, be responsible for all construction and all direct interface with project area pastoralists and agro-pastoralists. There would be four sections. The Construction Section, would be responsible for the execution or supervision of project construction activities and for building and fixed asset maintenance, as well as for dugout construction, borehole maintenance (Annex 5), landing strip construction and maintenance, and improvement of some of the roads in the project area. The Field Services Section, through the Range Officers stationed at regional or district headquarters, would be responsible for the delivery of extension packages (from the Extension and Agro-Pastoral Sections) to project area pastoralists and agro-pastoralists. Details relating to these activities are given in Annexes 2 and 3. Within the Extension Section, headed by the Chief Extension Officer, a Senior Training Officer would be responsible, under the direction of the Head of Extension Services, for the training and organisation of Subject Matter Specialists (SMSs), and a Senior Communications Officer would be responsible for all audio and supporting material for project extension. There would also be a computer/word processor operator. The Head Agro-Pastoralist in the Agro-pastoral Section would supervise the seed multiplication facility, which would be established by the project, and the adaptive trial sites. He would also be responsible for the Senior Arid Land Forester whose main areas of responsibility would include the selection, design and overall supervision of village reserves, village shelterbelts, village tree planting, live fences, and nurseries.

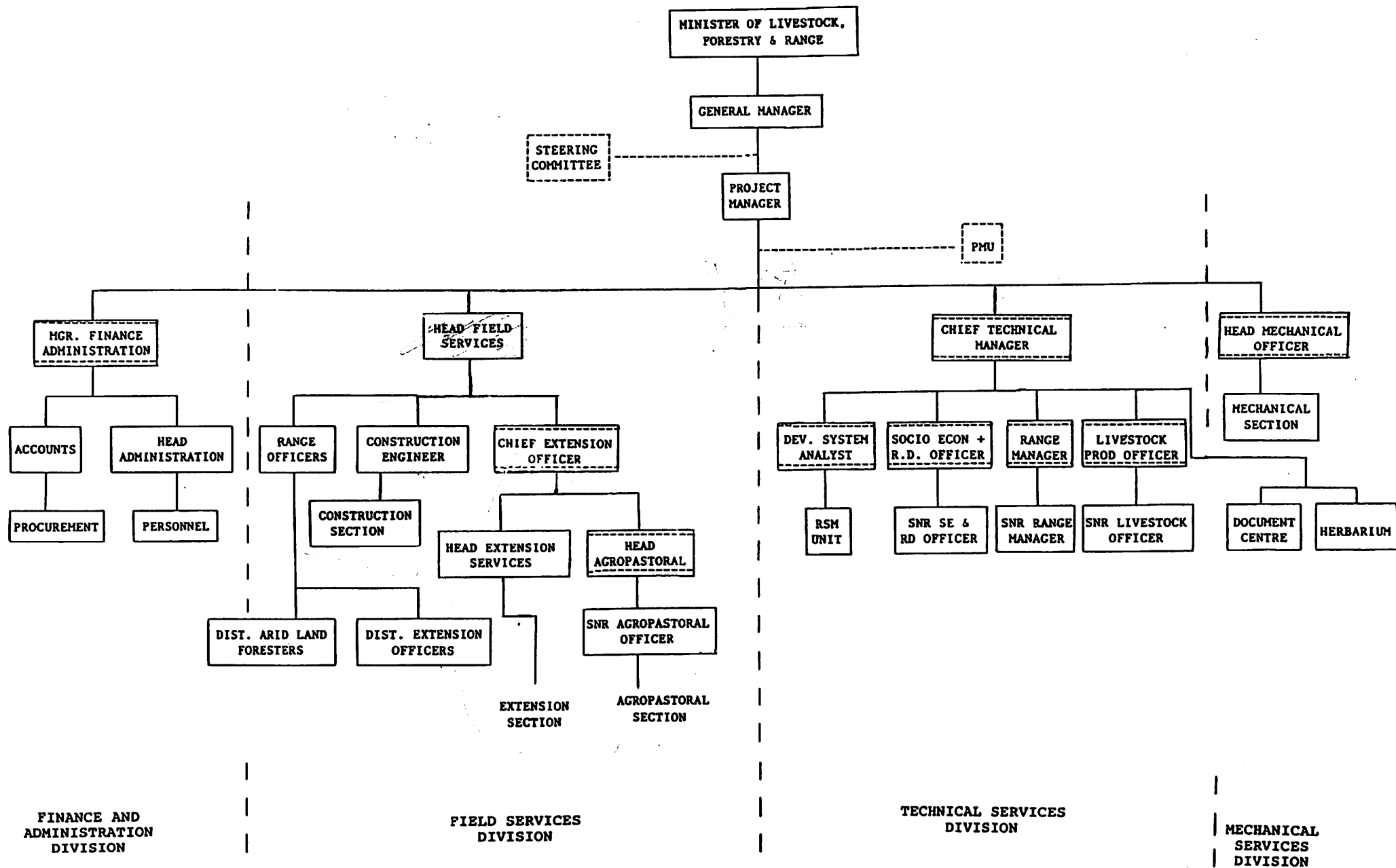
21. Finance and Administrative Division. The Manager of this Division would be responsible for the control of finance, accounting and administrative methods. The activities of the Division would include the design, preparation and maintenance of all financial records and accounts in accordance with the Somali Law and donors' requirements; procurement of all project inputs; and maintenance of appropriate store records, asset registers and other records required for the efficient operation of the project. The Division would also, through the Head of Administration, maintain all personnel records.

22. Mechanical Services Division. This Division would maintain all project vehicles, heavy equipment and borehole engines and pumps in good condition. It would order, in conjunction with the Finance and Administration Division, all necessary spare parts in a timely manner, and maintain and continually up-date a detailed spare parts stock record. Concurrently, it would build and maintain a team of experienced mechanics and support staff.

Organisation

23. Figures A6.1 to A6.4 show the inter-relationship between staff which would be required to implement phase II.

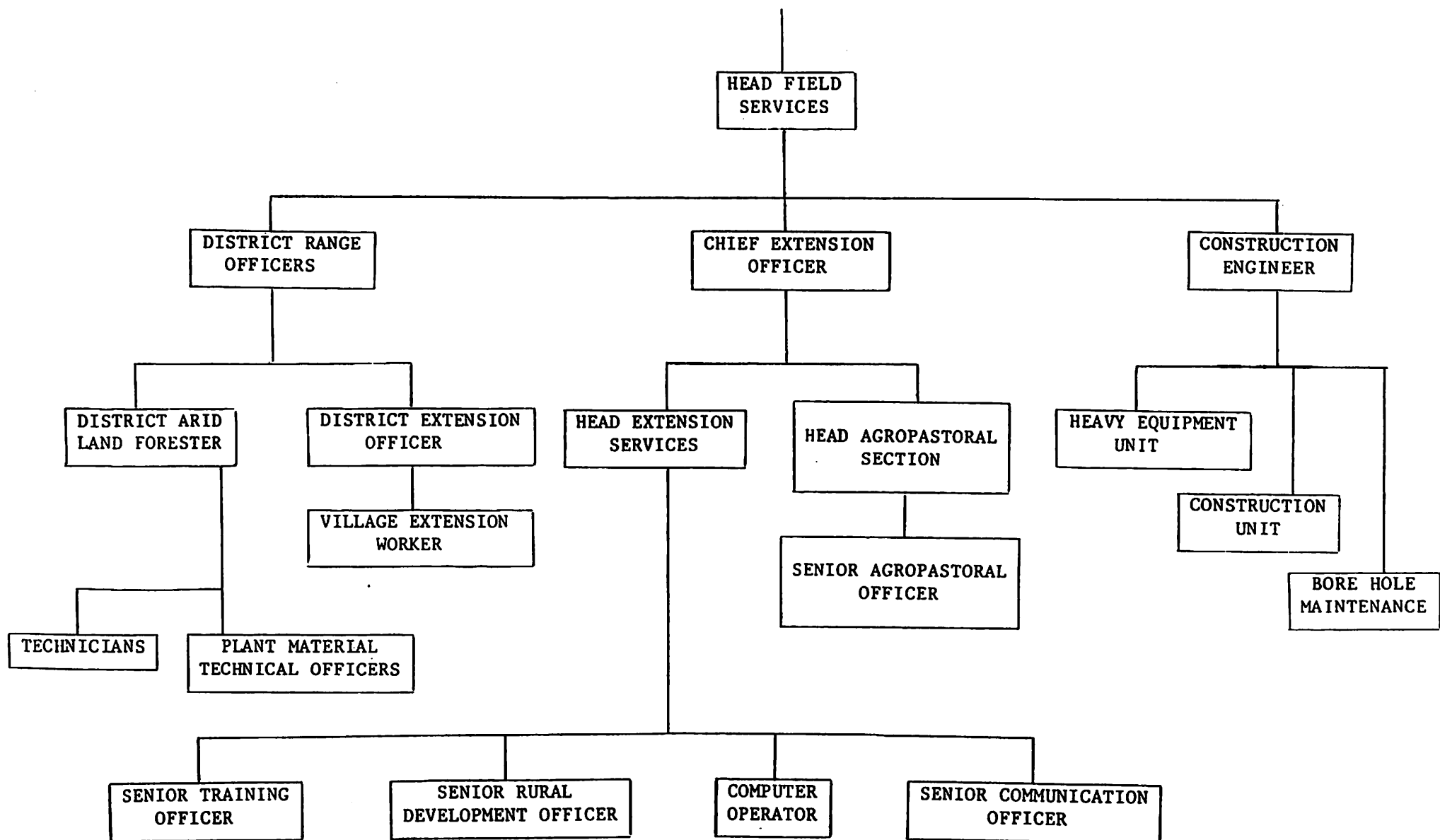
FIGURE A6.1 : CENTRAL RANGELANDS DEVELOPMENT PROJECT PHASE-II PROPOSED ORGANISATION



KEY

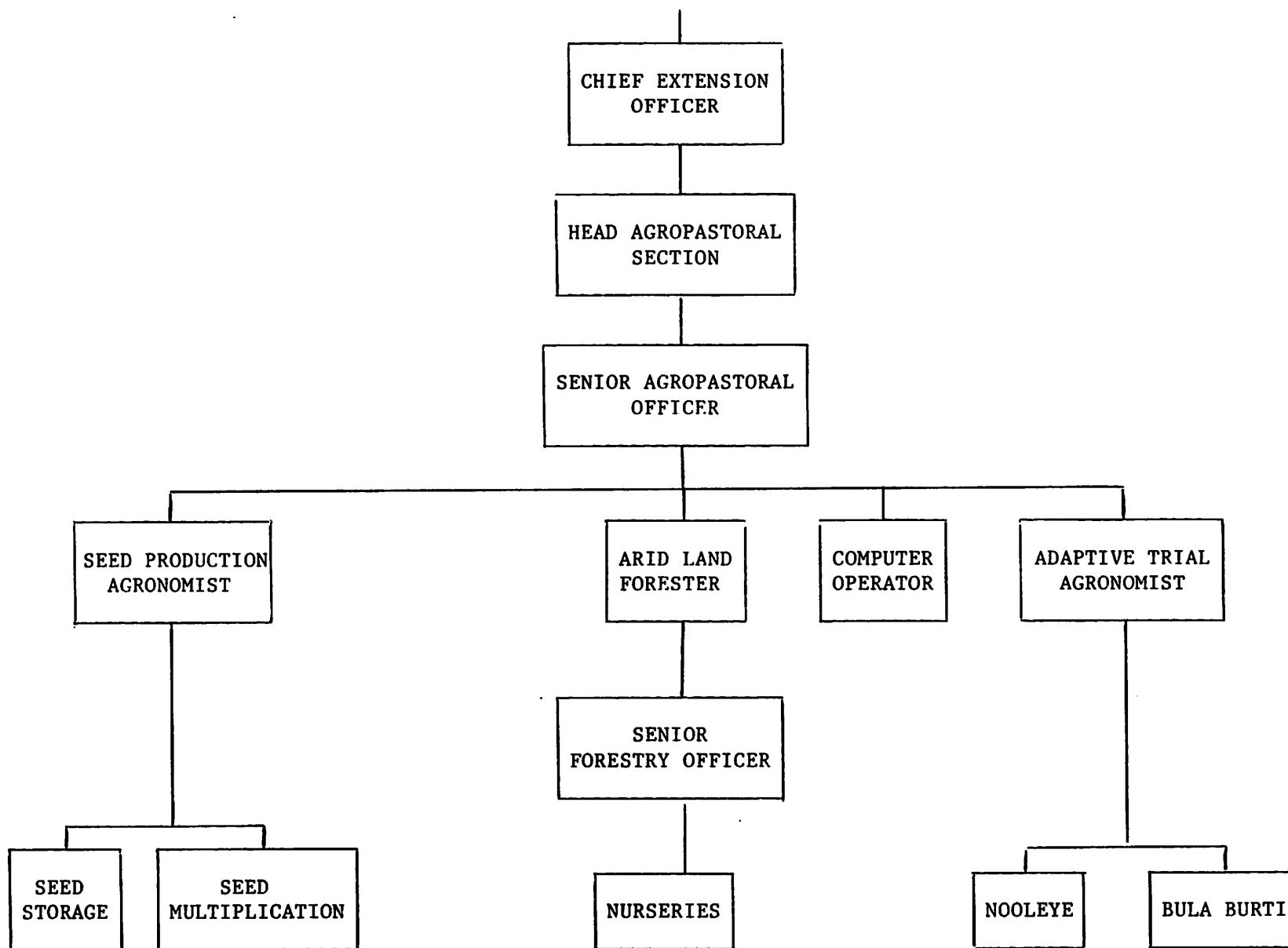
EXPATRIATE

FIGURE A6.2 : CENTRAL RANGELANDS DEVELOPMENT PROJECT PHASE-II PROPOSED ORGANISATION - FIELD SERVICES



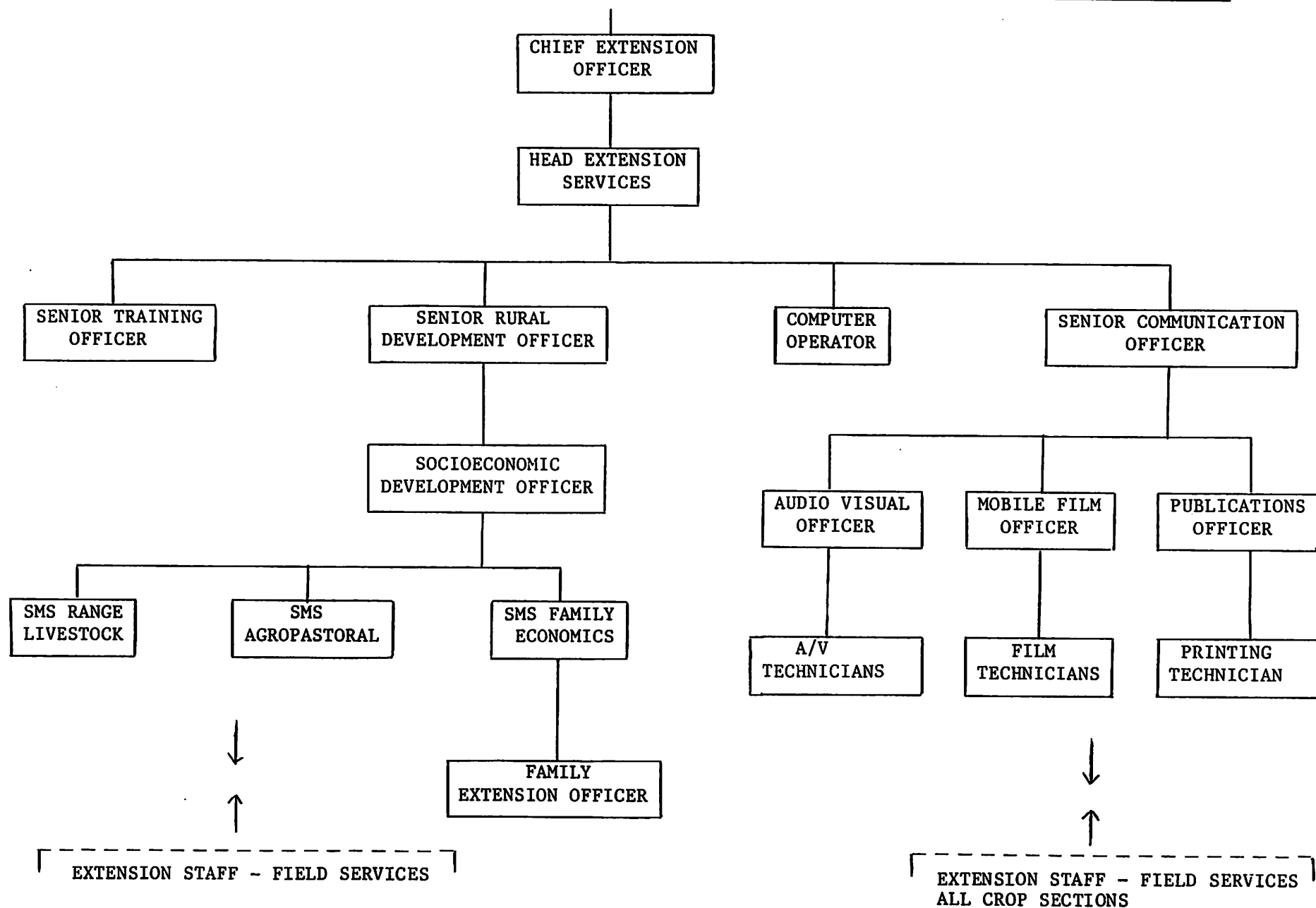
95

FIGURE A6.3: CENTRAL RANGELANDS DEVELOPMENT PROJECT PHASE-II PROPOSED ORGANISATION - AGROPASTORAL SECTION



26

FIGURE A6.4 : CENTRAL RANGELANDS DEVELOPMENT PROJECT PHASE-II PROPOSED ORGANISATION - EXTENSION SECTION



CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

PRICES AND COSTS

PRICES AND COSTSTABLE OF CONTENTS

	<u>Page</u>
A. INTRODUCTION	1
B. PRICES AND COSTS	1
Imported Items	1
Local Costs	1
Incremental Labour	1
USAID and GTZ-Funded Activities	1
Purchase of Vehicles	2
Physical Contingencies	2
Price Contingencies	2
Exchange Rates and Standard Conversion Factor	2

LIST OF TABLES

<u>Table</u>		
A7.1	: Staff Salaries, Allowances and Per Diems	3
A7.2	: Staffing Schedule, Administration	4
A7.3	: Staffing Schedule, Range and Livestock Services	5
A7.4	: Staffing Schedule, Field Services	6
A7.5	: Staffing Schedule, Extension	7
A7.6	: Staffing Schedule, Agro-Pastoral	8
A7.7	: Vehicle and Equipment Investment and Recurrent Costs	9
A7.8	: Investment Costs, Administration	10
A7.9	: Recurrent Costs, Administration	11
A7.10	: Investment Costs, Field Services	12
A7.11	: Recurrent Costs, Field Services	14
A7.12	: Investment Costs, Range Management	15
A7.13	: Recurrent Costs, Range Management	16
A7.14	: Investment and Recurrent Costs, SIMP	18
A7.15	: Investment and Recurrent Costs, Range and Livestock Services	19
A7.16	: Investment Costs, Extension	20
A7.17	: Recurrent Costs, Extension	21
A7.18	: Investment Costs, Agro-Pastoral	23
A7.19	: Recurrent Costs, Agro-Pastoral	25
A7.20	: Investment and Recurrent Costs, Livestock Production	27
A7.21	: Investment Costs, Water Development	29
A7.22	: Recurrent Costs, Water Development	30
A7.23	: Training Costs	31

PRICES AND COSTS

A. INTRODUCTION

1. This annex details the cost schedules for each project component and the separate activities which comprise a component, e.g. the Technical Services component consists of range management, SIMP and livestock production.

2. Each component/activity has two cost schedules; investment costs and recurrent costs and, where applicable, the recurrent cost schedules are supported by a staffing schedule. The staffing schedules show position, grade, salaries, allowances and per diems.

B. PRICES AND COSTS

Imported Items

3. All imported items have been costed in US\$ CIF and then converted to SoSh at a rate of SoSh 85 = US\$1.00. The SoSh CIF price was then reduced by 2% to reflect port clearance charges. This adjustment means that the foreign exchange percentage for imported items is 100%.

4. Fuel costs were based on imported fuel ex-Kenya because of the need to ensure that adequate fuel is available at all times. The project would not rely on fuel supplies imported directly through Mogadishu, although this cheaper source would be used whenever possible. The fuel prices used for project costing and analysis are:-

- (a) diesel 1/ : SoSh 32/1
- (b) petrol 1/ : SoSh 40/1

Local Costs

Local costs were determined from CRDP-I records and information collected during project preparation. Staff salaries were increased above current levels because of the need to provide greater incentives for active participation in project activities.

Incremental Labour

None of the productive interventions would require incremental labour inputs. Therefore, it was not necessary to consider the shadow price of labour. The cost of labour for the "non-productive" interventions (e.g. village tree planting) has been ignored or costed at full market rates (e.g. for sand dune stabilisation). This costing does not consider the possibility that the World Food Programme (WFP) might support some of the community development activities, because recent experience indicates that the supply of food is irregular. Therefore, all casual labour has been costed at SoSh 150/day. If WFP is able to support some aspects of the project, costs would be slightly lower than estimated in the tables in this annex.

USAID and GTZ-Funded Activities

At present, USAID and GTZ are funding range monitoring/development and livestock health/production activities. At the time of project preparation, it was not possible to obtain detailed budgets for these activities. Therefore, the costings for CRDP-II do not contain budgets for the USAID-funded range

1/ Including 5% for oil and lubricants.

monitoring/development work or costs for GTZ's livestock activities, during the first three years of the project. However, the Government of Somalia is committed to funding ongoing veterinary costs after withdrawal of GTZ's assistance and these costs have been included in years 4-6 of the project, refer Table A7.20. Similarly, project analysis ignores any benefits from the USAID-funded programme and it only considers benefits from livestock health (strategic deworming) after year 3. Benefits from ongoing support (by Government) for the veterinary laboratories have not been estimated. Detailed budgets for these ongoing activities (range and livestock development) may be available in time for project appraisal and therefore it might be possible to include additional costs and benefits for range management and veterinary laboratory activities in the appraisal report.

Purchase of Vehicles

The cost schedules in this annex indicate that the purchase of new and replacement vehicles has been staggered. However, it is recommended that all vehicles be procured through one contract with phased delivery dates. This would allow closer control of the vehicle fleet and some flexibility in the timing of vehicle replacement which, to a degree, would depend on the suitability of smaller four-wheel drives and motorbikes.

Physical Contingencies

Seven per cent physical contingencies were added to the cost of all items listed in the cost tables.

Price Contingencies

The price contingency rates used were:-

- (a) foreign : 1% years 2-3, 3.5% years 4-6 ¹/₁.
- (b) local : 10% for years 2-6 (based on the assumption that official and unofficial exchange rates are moving closer together).

Exchange Rates and Standard Conversion Factor

The official exchange rate at the commencement of project preparation was SoSh 85 = US\$1.00. The unofficial rate was about SoSh 120 = US\$1.00. The recent introduction of foreign exchange auctions and a revised Government policy indicates that the two exchange rates may move closer together by the time the project commences. However, as the position at the time of project preparation was unclear, the preparation team decided to use a SCF of 0.71 (SoSh 85/SoSh 120).

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.1 : STAFF SALARIES, ALLOWANCES AND PER DIEMS

GRADE	POSITION	MONTHLY SALARY (SS)	MONTHLY ALLOWANCES (SS)	DAYS PER DIEM PER MNTH	PER DIEM RATE (SS)	TOTAL PER DIEM PER MONTH (SS'000)	TOTAL PACKAGE PER MONTH (SS)	TOTAL PACKAGE PER YEAR (SS'000)
I	PROJECT MANAGER	7000	8000	10	500	5000	20000	240
II	REGIONAL DIRECTOR	4000	5000	20	300	6000	15000	180
	HQ ADMINISTRATION OFFICER	4000	5000	5	300	1500	10500	126
	PASTORAL ADVISER	4000	5000	20	300	6000	15000	180
III	COUNTERPARTS OF EXPATS.	3000	4500	20	300	6000	13500	162
	PRIORITY DISTRICT OFFICERS	3000	4500	20	300	6000	13500	162
	SENIOR MECHANIC	3000	4500	5	300	1500	9000	108
IV	REGIONAL OFFICERS	2500	3500	20	150	3000	9000	108
	REGIONAL ACCOUNTANT	2500	3500	5	150	750	6750	81
	HQ ACCOUNTANT	2500	3500	5	150	750	6750	81
	SUPPLY OFFICER	2500	3500	5	150	750	6750	81
	CLEARANCE OFFICER	2500	3500	5	150	750	6750	81
	CENTRAL STOREKEEPER	2500	3500	5	150	750	6750	81
	HEAVY EQUIPMENT CONTROLLER	2500	3500	20	150	3000	9000	108
	WORKSHOP FOREMAN	2500	3500	5	150	750	6750	81
V	ASSISTANT REGIONAL OFFICER	2000	2000	20	150	3000	7000	84
	NON-PRIORITY DISTRICT OFFICER	2000	2000	20	150	3000	7000	84
	TRANSPORT OFFICER	2000	2000	5	150	750	4750	57
	SECRETARIES	2000	2000	0	150	0	4000	48
	AUDIO VISUAL TECHNICIAN	2000	2000	20	150	3000	7000	84
	HQ ASSISTANT	2000	2000	0	150	0	4000	48
	STOREKEEPER	2000	2000	0	150	0	4000	48
	FILM PRODUCTION OFFICER	2000	2000	20	150	3000	7000	84
	MECHANIC	2000	2000	5	150	750	4750	57
	HEAVY EQUIPMENT OPERATOR	2000	2000	20	150	3000	7000	84
	SURVEYOR	2000	2000	20	150	3000	7000	84
	ADMIN. & PERSONNEL ASSISTANT	2000	2000	0	150	0	4000	48
	ACCOUNTS ASSISTANTS	2000	2000	0	150	0	4000	48
	STORES ASSISTANTS	2000	2000	0	150	0	4000	48
VI	DRIVERS	1500	1500	15	150	2250	5250	63
	TYPISTS	1500	1500	0	150	0	3000	36
	CLERKS	1500	1500	0	150	0	3000	36
	TELEX OPERATOR	1500	1500	0	150	0	3000	36
	TRANSLATOR	1500	1500	0	150	0	3000	36
	TECHNICIAN	1500	1500	0	150	0	3000	36
	ASSISTANT MECHANIC	1500	1500	5	150	750	3750	45
	TOOL KEEPER	1500	1500	5	150	750	3750	45
	DISTRICT STORE KEEPER	1500	1500	5	150	750	3750	45
VII	MESSANGER	1000	1000	0	150	0	2000	24
	CLEANER	1000	1000	0	150	0	2000	24
	WATCHMAN	1000	1000	0	150	0	2000	24
	SPANNER BOY	1000	1000	5	150	750	2750	33
	OTHER SUPPORT	1000	1000	5	150	750	2750	33

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.2 : STAFFING SCHEDULE, ADMINISTRATION

TABLE A-1. STAFF AND CONDUCTOR ADMINISTRATION																	
ADSTAFF		SALARY AND GRADE ALLOW.	TOTAL PER PACKAGE DIEMS (\$S'000)	YEAR PFF NO. COST	YEAR 1 NO. COST	YEAR 2 NO. COST	YEAR 3 NO. COST	YEAR 4 NO. COST	YEAR 5 NO. COST	YEAR 6 NO. COST	TOTAL NO. COST	TOTAL SALARY	TOTAL PER DIEM				
POSITION																	
ADMINISTRATION a/																	
PROJECT DIRECTOR	na	0	0	0	1	0	1	0	1	0	1	0	0	0			
PROJECT MANAGER	I	180	60	240	0	1	240	1	240	1	240	1	240	360			
FINANCIAL MANAGER (EXP)	UC	0	0	8500	0.5	4250	1	8500	1	8500	1	8500	51000	51000			
HEAD OF ADMINISTRATION	II	108	18	126	0	1	126	1	126	1	126	1	126	108			
PERSONNEL OFFICER	IV	72	9	81	0	1	81	1	81	1	81	1	81	54			
CLEARING OFFICER	IV	72	9	81	0	2	162	2	162	2	162	2	162	108			
SUPPLY OFFICER	IV	72	9	81	0	1	81	1	81	1	81	1	81	54			
FINANCIAL ACCOUNTANT	IV	72	9	81	0	1	81	1	81	1	81	1	81	54			
COST ACCOUNTANT	IV	72	9	81	0	1	81	1	81	1	81	1	81	54			
ASSISTANT ACCOUNT	V	48	9	57	0	4	228	4	228	4	228	4	228	216			
COMPUTER OPERATOR	IV	72	9	81	0	1	81	1	81	1	81	1	81	54			
CENTRAL STORE STAFF	V	48	0	48	0	4	192	4	192	4	192	4	192	0			
SECRETARY/TYPIST	V	48	0	48	0	12	576	12	576	12	576	12	576	0			
GUARD	VII	24	0	24	0	11	264	11	264	11	264	11	264	0			
DRIVER	VI	36	27	63	0	25	1575	25	1575	25	1575	25	1575	4050			
MESSANGER	VII	24	0	24	0	12	288	12	288	12	288	12	288	0			
CLEANER	VII	24	0	24	0	8	192	8	192	8	192	8	192	0			
MAINTENANCE SERVICE																	
MASTER MECHANIC (EXP)	UC	na	na	8500	0.5	4250	1	8500	1	8500	1	8500	0	42500			
SENIOR MECHANIC	III	90	18	108	0	1	108	1	108	1	108	1	108	108			
MECHANIC	V	48	9	57	0	5	285	5	285	5	285	5	285	270			
ASSISTANT MECHANIC	VI	36	9	45	0	4	180	4	180	4	180	4	180	216			
SPANNER BOY	VII	24	9	33	0	6	198	6	198	6	198	6	198	324			
TOOL KEEPER	VI	24	9	45	0	1	45	1	45	1	45	1	45	126			
PLANNING																	
PLANNING COUNTERPART	III	90	0	90	0	1	90	1	90	1	90	1	90	0			
TYPIST	V	48	0	48	0	1	48	1	48	1	48	1	48	0			
TOTAL				1	8500	107	22202	107	22202	107	22202	106	13702	642	124712	76056	48656
TOTAL LOCAL							5202	5202	5202	5202	5202	5202	31212				
TOTAL EXPAT.						17000	17000	17000	17000	17000	8500	93500					

✓ REFER TABLE A7.1 FOR DETAILS ON SALARIES, ALLOWANCES AND PER DIEMS.

104

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.3 : STAFFING SCHEDULE, RANGE AND LIVESTOCK SERVICES

RLSTAFF	ITEM	SALARY AND GRADE ALLOW.	PER DIBS	TOTAL PACKAGE SS'000	YEAR PPF NO. COST	YEAR 1 NO. COST	YEAR 2 NO. COST	YEAR 3 NO. COST	YEAR 4 NO. COST	YEAR 5 NO. COST	YEAR 6 NO. COST	TOTAL NO COST	TOTAL SALARY	TOTAL PER DIBS
POSITION														
CHIEF TECHNICAL MANAGER (EXP)		0	0	8500	0 1 8500	1 8500	1 8500	1 8500	1 8500	1 8500	1 8500	6 51000	51000	0
DEVELOPMENT SYSTEMS ANALYST (EXP)		0	0	8500	0 0.5 4250	1 8500	1 8500	1 8500	1 8500	0.5 4250	0	4 34000	34000	0
SOCIO ECON. & RURAL DEV. OFF. (EXP)		0	0	8500	0 0.5 4250	1 8500	1 8500	1 8500	1 8500	0.5 4250	0	4 34000	34000	0
RANGE MANAGER (EXP)		0	0	8500	0 1 8500	1 8500	1 8500	1 8500	1 8500	1 8500	0	5 42500	42500	0
LIVESTOCK PRODUCTION OFFICER (EXP)		0	0	8500	0 0.5 4250	1 8500	1 8500	1 8500	1 8500	0.5 4250	0	4 34000	34000	0
SUB TOTAL					0	29750	42500	42500	42500	29750	8500	195500	195500	0
SNR SOCIO ECON & RURAL DEV OFF	III	90	72	162	0 2 324	2 324	2 324	2 324	2 324	2 324	2 324	12 1944	1080	864
SNR RANGE MANAGER	III	90	72	162	0 2 324	2 324	2 324	2 324	2 324	2 324	2 324	12 1944	1080	864
HEAD REMOTE SENSING UNIT	III	90	72	162	0 2 324	2 324	2 324	2 324	2 324	2 324	2 324	12 1944	1080	864
SNR LIVESTOCK OFFICER	III	90	72	162	0 2 324	2 324	2 324	2 324	2 324	2 324	2 324	12 1944	1080	864
SUB TOTAL					0	1296	1296	1296	1296	1296	1296	7776	4320	3456
DOCUMENT CENTRE LIBRARIAN	V	48	0	48	0 1 48	1 48	1 48	1 48	1 48	1 48	1 48	6 288	288	0
HERBARIUM PROFESSIONAL STAFF ASSISTANTS	IV V	72 48	36 36	108 84	0 2 216 0 2 168	2 216 2 168	2 216 2 168	2 216 2 168	2 216 2 168	2 216 2 168	2 216 2 168	12 1296 12 1008	864 576	432 432
SUB TOTAL					0	384	384	384	384	384	384	2304	1440	864
SIMP STAFF R.S. MONITORING OFFICER	III	90	72	162	1 162	1 162	1 162	1 162	1 162	1 162	1 162	6 972	540	432
PHOTO INTERPRETER	IV	72	9	81	2 162	2 162	2 162	2 162	2 162	2 162	2 162	12 972	864	108
DRIVER	VI	36	27	63	3 189	3 189	3 189	3 189	3 189	3 189	3 189	18 1134	648	486
SUPPORT STAFF	V	48	9	57	0	0	0	2 114	2 114	2 114	2 114	8 456	384	72
SUB TOTAL					513	513	513	627	627	627	627	3534	2436	1098
RANGE MANAGEMENT STAFF OBSERVERS	IV	72	36	108	0 3 324	3 324	3 324	3 324	3 324	3 324	3 324	18 1944	1296	648
FLIGHT MONITORS	IV	72	36	108	0 1 108	1 108	1 108	1 108	1 108	1 108	1 108	6 648	432	216
DATA ANALYST	IV	72	9	81	0 1 81	1 81	1 81	1 81	1 81	1 81	1 81	6 486	432	54
COMPUTER OPERATOR	IV	72	9	81	0 1 81	1 81	1 81	1 81	1 81	1 81	1 81	6 486	432	54
DRIVER (FUEL TANKERS)	VI	36	26	63	0 3 189	3 189	3 189	3 189	3 189	3 189	3 189	18 1134	648	486
DRIVER (AGROPAST. STUDY)	VI	36	27	63	0 1 63	0	0	0	0	0	0	1 63	36	27
GUARDS	VII	24	0	24	0 6 144	6 144	6 144	6 144	6 144	6 144	6 144	36 864	864	0
SUB TOTAL					0	990	927	927	927	927	927	5625	4140	1485
GENERAL SUPPORT STAFF TECH. ASSISTANTS (FOR SIMP)	V	48	36	84	0 16 1344	16 1344	16 1344	16 1344	16 1344	16 1344	0	80 6720	3840	2880
FILING CLERKS	VI	36	0	36	0 5 180	5 180	5 180	5 180	5 180	5 180	5 180	30 1080	1080	0
SECRETARY/TYPIST	V	36	0	36	0 5 180	5 180	5 180	5 180	5 180	5 180	5 180	30 1080	1080	0
DRIVERS	VI	36	27	63	0 14 882	14 882	14 882	14 882	14 882	14 882	14 882	84 5292	3024	2268
SUB TOTAL					0	2586	2586	2586	2586	2586	1242	14172	9024	5148
TOTAL					513	35547	48254	48368	48368	35618	13024	229199	217148	12051
TOTAL LOCAL					513	5817	5754	5868	5868	5868	4524	33699		
TOTAL EXPAT					0	29750	42500	42500	42500	29750	8500	195500		

✓ REFER TABLE A7.1 FOR DETAILS ON SALARIES, ALLOWANCES AND PER DIBS.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.4 : STAFFING SCHEDULE, FIELD SERVICES

TABLE A7.4 : STAFFING SCHEDULE - FIELD SERVICES																
FSSTAFF	ITEM	SALARY AND GRADE ALLOW.	PER DIENS	TOTAL PACKAGE (\$5'000)	YEAR PPF NO. COST	YEAR 1 NO. COST	YEAR 2 NO. COST	YEAR 3 NO. COST	YEAR 4 NO. COST	YEAR 5 NO. COST	YEAR 6 NO. COST	TOTAL NO	TOTAL COST	TOTAL SALARY	TOTAL PER DIEM	
POSITION																
FIELD SERVICES SECTION																
	REGIONAL DIRECTOR ✓	II	108	72	180	0	3 540	3 540	3 540	3 540	3 540	18	3240	1944	1296	
	DISTRICT RANGE MANAGERS	III	90	72	162	0	5 810	7 1134	9 1458	11 1782	13 2106	58	9396	5220	4176	
	DISTRICT ARID LAND FORESTERS	IV	72	36	108	0	13 1404	13 1404	13 1404	13 1404	13 1404	78	8424	5616	2808	
	PLANT MATERIAL TECH. OFFICERS	IV	72	36	108	0	6 648	7 756	7 756	7 756	7 756	41	4428	2952	1476	
	DISTRICT EXTENSION OFFICERS	IV	72	36	108	0	18 1944	21 2268	27 2916	33 3564	39 4212	177	19116	12744	6372	
	SITE TECHNICIANS	V	48	36	84	0	12 1008	15 1260	18 23	21 1764	22 1848	111	7835	4477	3358	
	VILLAGE EXTENSION WORKERS	V	48	36	84	0	55 4620	68 5712	81 6804	94 7896	107 8988	525	44100	25200	18900	
	LABORERS (NURSERIES ETC.)	UC	31	0	31	0	54 1674	67 2077	79 2449	93 2883	105 3255	517	15965	15965	0	
SUPPORT STAFF																
	ACCOUNTANTS	IV	72	9	81	0	13 1053	13 1053	13 1053	13 1053	13 1053	78	6318	5616	702	
	SECRETARY/TYPIST	V	48	0	48	0	26 1248	26 1248	26 1248	26 1248	26 1248	156	7488	7488	0	
	DRIVERS - VEHICLES	VI	36	27	63	0	27 1701	34 2142	40 2520	46 2898	51 3213	253	15939	9108	6831	
	DRIVERS - TRACTORS	VI	36	0	36	0	6 1296	8 1584	10 1872	12 2160	13 2448	338	12168	12168	0	
	LABOURERS	UC	31	0	31	0	36 1116	44 1364	52 1612	60 1860	68 2108	338	10478	10478	0	
	CLEANERS	VII	24	0	24	0	26 624	26 624	26 624	26 624	26 624	156	3744	3744	0	
	GUARDS	VII	24	0	24	0	52 1248	52 1248	52 1248	52 1248	52 1248	312	7488	7488	0	
	TRAINEES, SIMP TEAMS	VI	36	27	63	0	14 882	14 882	14 882	14 882	14 882	84	5292	3024	2268	
	TRIAL HERDERS	UC			(NOT PAID)	0	2 0	2 0	2 0	2 0	2 0	12	0			
SUB TOTAL						0	368 21816	420 25296	472 27409	526 32562	574 35933	614 38403	3250 181419	133232	48187	
CONSTRUCTION SERVICES SECTION																
	HEAVY EQUIPMENT CONTROLLER	IV	72	36	108	0	1 108	1 108	1 108	1 108	1 108	6	648	432	216	
	WATER MAINTENANCE TEAM															
	MECHANICS	V	48	36	84	0	3 252	3 252	3 252	3 252	3 252	18	1512	864	648	
	DRIVER	VI	36	27	63	0	1 63	1 63	1 63	1 63	1 63	6	378	216	162	
	HEAVY EQUIPMENT CREW	V	48	36	84	0	9 756	9 756	9 756	9 756	9 756	54	4536	2592	1944	
	SURVEYERS	V	48	36	84	0	8 672	8 672	8 672	8 672	8 672	48	4032	2304	1728	
	FOREMAN, CAMEL DUGOUT MTCE.	V	48	36	84	0	2 168	2 168	2 168	2 168	2 168	12	1008	576	432	
	LABOURERS	VI	31	0	45	0	5 225	5 225	5 225	5 225	5 225	30	1350	930	420	
SUB TOTAL						0	29 2244	29 2244	29 2244	29 2244	29 2244	174 13464	7914	5550		
TOTAL (ALL LOCAL)						0	397 24060	449 27540	501 29453	555 34806	603 38177	643 40647	3424 194883			

✓ REFER TABLE A7.1 FOR DETAILS ON SALARIES, ALLOWANCES AND PER DIENS.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.5 : STAFFING SCHEDULE, EXTENSION

EXTSTAFF		SALARY AND GRADE ALLOW.	PER DIEMS	TOTAL PACKAGE SS'000	YEAR PPF NO. COST	YEAR 1 NO. COST	YEAR 2 NO. COST	YEAR 3 NO. COST	YEAR 4 NO. COST	YEAR 5 NO. COST	YEAR 6 NO. COST	TOTAL NO. COST	TOTAL SALARY	TOTAL PER DIEM
ITEM														
POSITION														
HEAD OFFICE a/														
CHIEF EXTENSION OFFICER (EXP)	UC	0	0	8500	0.5 4250	1 8500	1 8500	1 8500	1 8500	1 8500	1 8500	6 51000	51000	0
HEAD EXTENSION SERVICES	II	108	72	180	0 1 180	1 180	1 180	1 180	1 180	1 180	1 180	6 1080	648	432
SENIOR TRAINING OFFICER	III	90	72	162	0 1 162	1 162	1 162	1 162	1 162	1 162	1 162	6 972	540	432
SUBJECT MATTER SPECIALISTS														
RANGE/LIVESTOCK	IV	72	36	108	0 1 108	1 108	1 108	1 108	1 108	1 108	1 108	6 648	432	216
AGROPASTORAL	IV	72	36	108	0 1 108	1 108	1 108	1 108	1 108	1 108	1 108	6 648	432	216
FAMILY ASSISTANT	IV	72	36	108	0 1 108	1 108	1 108	1 108	1 108	1 108	1 108	6 648	432	216
FAMILY EXTENSION	V	48	36	84	0 1 84	1 84	1 84	1 84	1 84	1 84	1 84	6 504	288	216
SENIOR RURAL DEVEL. OFFICER	III	90	72	162	0 1 162	1 162	1 162	1 162	1 162	1 162	1 162	6 972	540	432
SOCIO ECONOMIST	IV	72	36	108	0 1 108	1 108	1 108	1 108	1 108	1 108	1 108	6 648	432	216
SENIOR COMMUN. OFFICER	III	90	72	162	0 1 162	1 162	1 162	1 162	1 162	1 162	1 162	6 972	540	432
PUBLICATIONS OFFICER	IV	72	9	81	0 1 81	1 81	1 81	1 81	1 81	1 81	1 81	6 486	432	54
FILM OFFICER	IV	72	9	81	0 1 81	1 81	1 81	1 81	1 81	1 81	1 81	6 486	432	54
TECHNICIAN - PRINTING	V	48	9	57	0 1 57	1 57	1 57	1 57	1 57	1 57	1 57	6 342	288	54
- FILMS	V	48	9	57	0 1 57	1 57	1 57	1 57	1 57	1 57	1 57	6 342	288	54
- AUDIO VISUAL AIDS	V	48	9	57	0 1 57	1 57	1 57	1 57	1 57	1 57	1 57	6 342	288	54
- RADIO/MASS MEDIA	V	48	9	57	0 2 114	2 114	2 114	2 114	2 114	2 114	2 114	12 684	576	108
- PRINTING	V	48	9	57	0 1 57	1 57	1 57	1 57	1 57	1 57	1 57	6 342	288	54
AUDIO VISUAL PRODUCTIONIST	IV	72	9	81	0 1 81	1 81	1 81	1 81	1 81	1 81	1 81	6 486	432	54
COMPUTER OPERATOR	V	48	9	57	0 1 57	1 57	1 57	1 57	1 57	1 57	1 57	6 342	288	54
FIELD ENUMERATORS	VI	36	27	63	0 4 252	4 252	4 252	4 252	4 252	0	0	1008	576	432
TYPIST	VI	36	0	36	0 2 72	2 72	2 72	2 72	2 72	2 72	2 72	12 432	432	0
DRIVERS	VI	36	27	63	0 9 567	9 567	9 567	9 567	9 567	9 567	9 567	54 3402	1944	1458
SECRETARY/CLERK	VI	36	0	36	0 2 72	2 72	2 72	2 72	2 72	2 72	2 72	12 432	432	0
CLEANERS	VII	24	0	24	0 2 48	2 48	2 48	2 48	2 48	2 48	2 48	12 288	288	0
TOTAL					0.5 4250	39 11335	39 11335	39 11335	39 11335	35 11083	35 11083	211 67506	62268	5238
TOTAL LOCAL						2835	2835	2835	2835	2583	2583	16506		
TOTAL EXPAT.						8500	8500	8500	8500	8500	8500	51000		

a/ REFER TABLE A7.1 FOR DETAILS ON SALARIES, ALLOWANCES AND PER DIEMS.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.6 : STAFFING SCHEDULE, AGROPASTORAL

AGROSTAF		SALARY AND PER PACKAGE		YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL		TOTAL		TOTAL	
ITEM		GRADE	ALLOW.	DIEHS (\$5'000)	NO.	COST	NO.	COST	NO.	COST	NO.	COST	NO.	COST	NO.	COST	NO.	COST	NO.	COST	TOTAL	PER	DIEH
POSITION																							
HEAD OFFICE a/																							
HEAD AGROPASTORAL SECTION (EXP.)UC		0	0	8500	0	1	8500	1	8500	1	8500	1	8500	1	8500	1	8500	6	51000	51000	0		
SENIOR AGROPASTORAL OFFICER III		90	70	162	0	1	162	1	162	1	162	1	162	1	162	1	162	6	972	340	432		
ARID LAND FORESTER III		90	70	162	0	1	162	1	162	1	162	1	162	1	162	1	162	6	972	340	432		
SENIOR FORESTORY OFFICER III		90	70	162	0	1	162	1	162	1	162	1	162	1	162	1	162	6	972	340	432		
COMPUTER OPERATOR V		48	9	57	0	1	57	1	57	1	57	1	57	1	57	1	57	6	342	288	54		
TYPIST VI		36	0	36	0	1	36	1	36	1	36	1	36	1	36	1	36	6	216	216	0		
DRIVER VI		36	27	63	0	5	315	5	315	5	315	5	315	5	315	5	315	30	1890	1080	810		
SEED MULT. & STORAGE CENTRE																							
SEED PRODUCTION AGRONOMIST IV		72	9	81	1	41	1	81	1	81	1	81	1	81	1	81	1	81	6	486	432	54	
FARM MANAGER IV		72	9	81	1	41	1	81	1	81	1	81	1	81	1	81	1	81	6	486	432	54	
FARM FOREMAN V		48	9	57	1	29	1	57	1	57	1	57	1	57	1	57	1	57	6	342	288	54	
SEED TECHNICIAN V		48	9	57	1	29	1	57	1	57	1	57	1	57	1	57	1	57	6	342	288	54	
SEED STORE ASSISTANT VI		36	9	45	1	23	1	45	1	45	1	45	1	45	1	45	1	45	6	342	288	54	
SEED LAB. ASSISTANT V		48	9	57	1	29	1	57	1	57	1	57	1	57	1	57	1	57	6	342	288	54	
TYPIST/CLERK VI		36	0	36	1	18	1	36	1	36	1	36	1	36	1	36	1	36	6	216	216	0	
PUMP OPERATER VI		36	9	45	1	23	1	45	1	45	1	45	1	45	1	45	1	45	6	342	288	54	
WORKERS UC		31	0	31	1	16	6	186	6	186	6	186	6	186	6	186	6	186	36	1116	1116	0	
DRIVER VI		36	0	36	1	18	2	72	2	72	2	72	2	72	2	72	2	72	12	432	432	0	
GUARDS VII		24	0	24	1	12	3	72	3	72	3	72	3	72	3	72	3	72	18	432	432	0	
CLEANERS VII		24	0	24	1	12	2	48	2	48	2	48	2	48	2	48	2	48	12	288	288	0	
ADAPTIVE TRIALS																							
ADAPTIVE TRIAL AGRONOMIST IV		72	9	81	0	1	81	1	81	1	81	1	81	1	81	1	81	6	486	432	54		
OFFICER IN-CHARGE, TRIALS V		48	9	57	0	2	114	2	114	2	114	2	114	2	114	2	114	12	684	576	108		
TECHNICAL OFFICERS VI		36	9	45	0	3	135	3	135	3	135	3	135	3	135	3	135	18	810	648	162		
GUARDS VII		24	0	24	0	10	240	10	240	10	240	10	240	10	240	10	240	60	1440	1440	0		
CLEANERS VII		24	0	24	0	6	144	6	144	6	144	6	144	6	144	6	144	36	864	864	0		
DRIVER VI		36	0	36	0	2	72	2	72	2	72	2	72	2	72	2	72	12	432	432	0		
WORKERS UC		31	0	31	0	2	62	2	62	2	62	2	62	2	62	2	62	12	372	372	0		
TOTAL					287	58	11079	58	11079	58	11079	58	11079	58	11079	58	11079	354	66474	63612	2862		
TOTAL LOCAL							2579		2579		2579		2579		2579		2579		15474				
TOTAL EXPAT							8500		8500		8500		8500		8500		8500		51000				

a/ REFER TABLE A7.1 FOR DETAILS ON SALARIES, ALLOWANCES AND PER DIEHS.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.7 : VEHICLE AND EQUIPMENT INVESTMENT AND RECURRENT COSTS

VEHCOST	ITEM	US\$ CIF	CIF a/ (SS'000)	ADJUSTED b/ (SS'000)	SPARES (15%)	TOTAL (SS'000)	FUEL USE/YR (L)		FUEL COST c/ (SS'000)	R&M (10%)	TOTAL COST (SS'000)
							PETROL	DIESEL			
PICKUP		6000	510	500	75	575		1500	48	50	98
4 WD (LARGE)		13000	1105	1083	162	1245		3500	112	108	220
4 WD (SMALL)		8000	680	666	100	766		2750	88	67	155
SALOON		7000	595	583	87	671	1500		60	58	116
MOTOR BIKE		2500	213	208	31	239	700		28	21	49
SCOOTER		700	60	58	9	67	200		8	6	14
TRUCK		38000	3230	3165	475	3640		11000	352	317	669
4 WD BUS		30000	2550	2499	375	2874		6000	192	250	442
4 WD AUDIO VISUAL UNIT		20000	1700	1666	250	1916		4000	128	167	295
BUS (FOR ADMIN. STAFF)		10000	850	833	125	958		2500	80	83	163
TANKER		45000	3825	3749	562	4311		11000	352	375	727
MOBILE WORKSHOP		63000	5355	5248	787	6035		4500	144	525	669
GRADER		115000	9775	9580	1437	11016		30000	960	958	1918
LOADER		40000	3400	3332	500	3832		10000	320	333	653
DOZER		150000	12750	12495	1874	14369		45000	1440	1250	2690
HEAVY TRAILER		9000	765	750	112	862				75	75
TRACTOR & TRAILER		12500	1063	1041	156	1197		7000	224	104	328
TRACTOR, TRAILER & BUCKET		15500	1318	1291	194	1485		7000	224	129	353
FUEL/WATER TANKS		800	68	67	10	77				7	7

a/ BASED ON SS85 = US\$1.00

b/ REDUCED BY 2% TO REFLECT PORT CLEARANCE CHARGES.

c/ INCLUDING AN ADDITIONAL 2% FOR OIL AND LUBRICANTS.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.8 : INVESTMENT COSTS. ADMINISTRATION

ADIFE			UNIT		YEAR PFF	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL					
	ITEM	FE	COST		NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL
BUILDINGS																							
	HOUSES & FURN. FOR EXPATS	EA	0.85	7225	0	10	72250	61413	0	0	0	0	0	0	0	0	10	72250	61413	10838			
WORKSHOP ALTERATIONS																							
	FLOOR IN STORE ROOM	M2	0.85	26	0	100	2600	2210	0	0	0	0	0	0	0	0	100	2600	2210	390			
	RELOCATE ABLUTIONS BLOCK	M2	0.85	26	0	25	650	553	0	0	0	0	0	0	0	0	25	650	553	98			
	RECEPTION AREA FOR VEHICLES	L SUM	0.85	640	0	1	640	544	0	0	0	0	0	0	0	0	1	640	544	96			
	VEHICLE RAMPS	L SUM	0.85	425	0	1	425	361	0	0	0	0	0	0	0	0	1	425	361	64			
	CEMENT WORK AREA	M2	0.85	17	0	30	510	434	0	0	0	0	0	0	0	0	30	510	434	77			
	DARK ROOM b/	M2	0.85	17	30	510	30	510	434	0	0	0	0	0	0	0	0	510	434	77			
SUB TOTAL					510	77585	65947	0	0	0	0	0	0	0	0	0	77585	65947	11638				
VEHICLES a/																							
	SALOONS	EA	1.00	671	0	3	2013	2013	0	0	0	0	3	2013	2013	0	0	6	4026	4026	0		
	4WD (L)	EA	1.00	1245	0	3	3735	3735	0	0	0	0	3	3735	3735	0	0	6	7470	7470	0		
	4WD (S)	EA	1.00	766	0	4	3064	3064	0	0	0	0	4	3064	3064	0	0	8	6128	6128	0		
	PICKUP	EA	1.00	575	0	2	1150	1150	0	0	0	0	2	1150	1150	0	0	4	2300	2300	0		
	SCOOTER	EA	1.00	67	0	3	201	201	0	0	0	0	3	201	201	0	0	6	402	402	0		
	PASSENGER BUS	EA	1.00	959	0	2	1916	1916	0	0	0	0	2	1916	1916	0	0	4	3832	3832	0		
	TRUCK	EA	1.00	3640	0		0	0	0	0	0	0	2	7280	7280	0	0	2	7280	7280	0		
SUB TOTAL					0	12079	12079	0	0	0	0	19359	19359	0	0	0	0	31438	31438	0			
OFFICE EQUIPMENT & FURNITURE																							
	PHOTO COPIER	EA	1.00	292	4	1168	4	1168	1168	0	0	0	0	4	1168	1168	0	0	8	2336	2336	0	
	FURNITURE	SET	1.00	250	0	8	2000	2000	0	0	1	250	250	0	0	0	0	9	2250	2250	0		
	COMPUTER & SOFTWARE	EA	1.00	417	1	417	1	417	417	0	0	0	0	0	0	0	0	1	417	417	0		
	AIR CONDITIONERS	EA	1.00	83	0	5	415	415	5	415	415	0	0	0	0	0	0	0	830	830	0		
SUB TOTAL					1585	4000	4000	415	415	250	250	1168	1168	0	0	0	0	5833	5833	0			
WORKSHOP EQUIPMENT																							
	WELDING SET	EA	1.00	666	0	2	1332	1332	0	0	0	0	0	0	0	0	2	1332	1332	0			
	HYDRAULIC CRANE	EA	1.00	833	0	1	833	833	0	0	0	0	0	0	0	0	1	833	833	0			
	HYDRAULIC JACK	EA	1.00	83	0	10	830	830	0	0	0	0	0	0	0	0	10	830	830	0			
	GRINDING MACHINE	EA	1.00	417	0	1	417	417	0	0	0	0	0	0	0	0	1	417	417	0			
	WORKSHOP PRESS	EA	1.00	417	0	2	834	834	0	0	0	0	0	0	0	0	2	834	834	0			
	TOOL SET	SET	1.00	417	0	3	1251	1251	0	0	0	0	0	0	0	0	3	1251	1251	0			
	MISCELLANEOUS TOOLS	SET	1.00	340	0	1	340	340	0	0	0	0	0	0	0	0	1	340	340	0			
SUB TOTAL					0	5837	5837	0	0	0	0	0	0	0	0	0	0	5837	5837	0			
TOTAL					2095	99501	87863	415	415	250	250	20527	20527	0	0	0	0	120693	109055	11638			
TOTAL FOREIGN EXCHANGE							87863	415	250	20527	0	0	109055										
TOTAL LOCAL CURRENCY							11638	0	0	0	0	0	11638										
ADJUSTED TOTAL (1/1/88 PRICES)							104464	427	258	21143	0	0	126292										
PHYSICAL CONTINGENCIES							7313	30	18	1480	0	0	8840										
TOTAL COST							111777	457	276	22623	0	0	135133										
ECONOMIC COST							102855	444	268	21964	0	0	125530										

a/ REFER TABLE A7.7 FOR DETAILS.

b/ MODIFICATIONS TO AN EXISTING ROOM.

SWAZI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.9 : RECURRENT COSTS, ADMINISTRATION

ADDFE	ITEM		FE	UNIT	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL		FE	LOCAL				
				COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.			COST	FE		
STAFF COSTS - LOCAL (TABLE A7.2)	YR	0.00	VAR		0	0	1	5202	0	1	5202	0	1	5202	0	1	5202	0	1	5202	0	6	31212	0	31212	
STAFF COSTS - EXPAT (TABLE A7.2)	YR	1.00	VAR		0	0	1	17000	17000	1	17000	17000	1	17000	17000	1	17000	17000	1	8500	8500	6	93500	93500	0	
BUILDING MAINTENANCE a/	YR	0.85		1552	0	0	1	1552	1319	1	1552	1319	1	1552	1319	1	1552	1319	1	1552	1319	6	9312	7915	1397	
ELECTRICITY AND WATER	YR	0.85		1700 0.50	850	723	1	1700	1445	1	1700	1445	1	1700	1445	1	1700	1445	1	1700	1445	6	10200	8670	1530	
MTCE.. PHOTOCOPY & COMPUTER	YR	1.00		170 0.50	85	85	1	170	170	1	170	170	1	170	170	1	170	170	1	170	170	6	1020	1020	0	
MTCE.. OFFICE FURNITURE	L	SUM	0.95		85 0.50	43	40	1	85	81	1	85	81	1	85	81	1	85	81	1	85	81	6	510	485	26
VEHICLE OPERATION AND MAINTENANCE b/																										
SALOON CARS	YR	1.00		118	1	118	118	3	354	354	3	354	354	3	354	354	3	354	354	3	354	354	18	2124	2124	0
4WD (L)	YR	1.80		220	2	440	440	3	660	660	3	660	660	3	660	660	3	660	660	3	660	660	18	3960	3960	0
4WD (S)	YR	1.00		155	2	310	310	4	620	620	4	620	620	4	620	620	4	620	620	4	620	620	24	3720	3720	0
PICKUP	YR	1.80		98	1	98	98	2	196	196	2	196	196	2	196	196	2	196	196	2	196	196	12	1176	1176	0
SCOOTER	YR	1.00		49	0	0	0	3	147	147	3	147	147	3	147	147	3	147	147	3	147	147	18	882	882	0
PASSENGER BUS	YR	1.00		163	0	0	2	326	326	2	326	326	2	326	326	2	326	326	2	326	326	12	1956	1956	0	
TRUCK	YR	1.80		669	0	0	2	1338	1338	2	1338	1338	2	1338	1338	2	1338	1338	2	1338	1338	12	8028	8028	0	
MOBILE WORKSHOP	YR	1.80		669	0	0	2	1338	1338	2	1338	1338	2	1338	1338	2	1338	1338	2	1338	1338	12	8028	8028	0	
SUB TOTAL					966	966	4979	4979	4979	4979	4979	4979	4979	4979	4979	4979	4979	4979	4979	4979	29874	29874	0			
GENERAL OFFICE SUPPLIES	YR	0.90		1000 0.50	500	450	1	1800	900	1	1800	900	1	1800	900	1	1800	900	1	1800	900	6	6000	5400	600	
AUDIT FEES	YR	1.00		1700	0	0	1	1700	1700	1	1700	1700	1	1700	1700	1	1700	1700	1	1700	1700	6	10200	10200	0	
SALARY STUDIES CONSULTANCY	MM	1.00		850	0	0	2	1700	1700	0	0	0	0	0	0	0	0	0	0	0	0	2	1700	1700	0	
PROJECT REVIEW	MM	1.00		850	0	0	0	0	0	0	0	0	0	0	0	5	4250	4250	0	0	5	4250	4250	0		
MOBBIO PORT STUDY	MM	1.00		850	0	0	3	2550	2550	0	0	0	0	0	0	0	0	0	0	0	3	2550	2550	0		
GENERAL REPORTS/PUBLICATIONS	YR	0.85		850 0.50	425	361	1	850	723	1	850	723	1	850	723	1	850	723	1	850	723	6	5100	4335	765	
PROJECT MANAGER'S EXPENSES	YR	0.50		340 0.50	170	85	1	340	170	1	340	170	1	340	170	1	340	170	1	340	170	6	2040	1020	1020	
STAFF WELFARE	YR	1.00		900 0.50	450	450	1	900	900	1	900	900	1	900	900	1	900	900	1	900	900	6	5400	5400	0	
STAFF UNIFORMS	YR	0.60		900 0.50	450	270	1	900	540	1	900	540	1	900	540	1	900	540	1	900	540	6	5400	3240	2160	
SEMINARS, WORKSHOPS & CONFERENCES	YR	0.30		1000	0	0	1	1000	300	1	1000	300	1	1000	300	1	1000	300	1	1000	300	6	6000	1800	4200	
EXPAT HOUSE RENTAL	YR	0.00		4590	0	0	1	4590	0	1	2295	0	0	0	0	0	0	0	0	0	2	6885	0	6885		
IMPORT CLEARANCE COSTS (NOT DUTY)	YR	0.00		VAR	500	0	1	4722	0	1	1629	0	1	1249	0	1	3089	0	1	1350	0	6	13381	0	13381	
WORKSHOP GENERAL SUPPLIES	YR	1.00		417 0.50	209	209	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	6	2502	2502	0	
TOTAL					4647	3639	51357	34893	41719	30643	39044	30643	40884	30643	43395	34893	30637	22143	247036	183861	63175					
TOTAL FOREIGN EXCHANGE								34893		30643		30643		30643		34893		22143		183861						
TOTAL LOCAL CURRENCY								16464		11076		8401		10241		8502		8494		63175						
ADJUSTED TOTAL (1/1/88 PRICES)								55697		44853		41643		43951		46142		33000		265187						
PHYSICAL CONTINGENCIES								3899		3140		2915		3070		3230		2310		18543						
TOTAL COST								59595		47993		44558		46921		49372		35310		283750						
ECONOMIC COST c/								49843		41203		39170		40568		43795		30146		244725						

a/ % OF INVESTMENT COSTS.

b/ REFER TABLE A7.7.

c/ REFER TO SECTION ON METHODOLOGY FOR DETAILS ON CALCULATIONS.

SOMALIA DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.10 : INVESTMENT COSTS, FIELD SERVICES

PSIFE	ITEM	UNIT	FE (%)	UNIT COST (\$\$'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL								
					NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL		
BUILDINGS																											
	DISTRICT HEAD QUARTERS (400 M2)	EA	0.85	8500	0	1	8500	7225	1	8500	7225	1	4250	3613	0	0	0	0	0	0	0	0	3	21250	18043	3188	
	GUTTERING/TANKS FOR DIST. HD a/	EA	1.08	209	0	3	627	627	3	627	627	2	418	418	2	418	418	2	418	418	1	209	209	13	2717	2717	0
	STORES (90 M2)	EA	0.85	1170	0	3	3510	2984	3	3510	2984	3	3510	2984	3	3510	2984	1	1170	995	0	0	13	15210	12929	2282	
	SHELTERS (LOCAL MATERIALS)	EA	0.50	170	0	3	510	255	3	510	255	3	510	255	3	510	255	1	170	85	0	0	13	2210	1105	1105	
	SHELTERS (AT TRAINING CENTRES)	EA	0.85	340	0	2	680	578	0	0	0	0	0	0	0	0	0	0	0	0	0	2	680	578	102		
HOUSES																											
	SINGLE HOUSE (50 M2)	EA	0.85	750	0	3	2250	1913	2	1500	1275	2	1500	1275	2	1500	1275	2	1500	1275	2	1500	1275	13	9750	8288	1463
	MARRIED HOUSE (80 M2)	EA	0.85	1680	0	7	11760	9996	7	11760	9996	7	11760	9996	6	10080	8568	6	10080	8568	6	10080	8568	39	65520	55692	9828
SUB TOTAL					0		27837	23577		26407	22362		21948	18540		16018	13500		13338	11341		11789	10052		117337	99371	17967
VEHICLES b/																											
	4 WD (S) (DISTRICT EXT. OFF.)	EA	1.00	766	0	18	13788	13788	5	3830	3830	4	3064	3064	22	16852	16852	4	3064	3064	4	3064	3064	57	43662	43662	0
	4 WD (S) (DISTRICT RANGE OFF.)	EA	1.00	766	0	6	4596	4596	2	1532	1532	2	1532	1532	7	5362	5362	1	766	766	1	766	766	19	14554	14554	0
	4 WD (S) (REGIONAL DIRECTORS)	EA	1.00	766	0	3	2298	2298	0	0	0	0	0	0	3	2298	2298	0	0	0	0	0	6	4596	4596	0	
	TRUCK (TIPPER)	EA	1.00	4119	0	1	4119	4119	0	0	0	0	0	1	4119	4119	0	0	0	0	0	0	2	8238	8238	0	
SUB TOTAL					0		24801	24801		5362	5362		4596	4596		28631	28631		3830	3830		3830	3830		71050	71050	0
EQUIPMENT																											
	TRACTOR, TRAILER AND BUCKET c/	EA	1.00	1341	0	6	8046	8046	2	2682	2682	2	2682	2682	2	2682	2682	1	1341	1341	0	0	13	17433	17433	0	
	CAMPING EQUIPMENT d/	SET	1.00	250	20	5000	40	10000	10800	0	0	0	0	0	20	5000	5000	0	0	0	0	0	80	15000	15000	0	
SUB TOTAL					5000		18046	18046		2682	2682		2682	2682		7682	7682		1341	1341		0	0		32433	32433	0
CONTINUED OVERLEAF																											

CONTINUED OVERLEAF

SOMALIA DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.10 : INVESTMENT COSTS, FIELD SERVICES

FS/FE	ITEM	UNIT		YEAR PPF	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL						
		FE	COST		NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL			
CONTINUED																							
CONSTRUCTION EQUIPMENT b/																							
	GRADER (ADDITIONAL)	1.00	11495	0	0	0	1	11495	11495	0	0	0	0	0	0	0	0	1	11495	11495	0		
	LOADER	1.00	3332	0	1	3332	3332	0	0	0	0	0	0	0	0	0	0	1	3332	3332	0		
	HEAVY DUTY TRAILER	1.00	750	0	1	750	750	0	0	0	0	0	0	0	0	0	0	1	750	750	0		
	WATER TANK	0.85	68	0	15	1020	867	0	0	0	0	0	0	0	0	0	0	15	1020	867	153		
	FUEL TANK	0.85	68	0	20	1360	1156	0	0	0	0	0	0	0	0	0	0	20	1360	1156	204		
SUB TOTAL				0	6462	6105		11495	11495	0	0	0	0	0	0	0	0	17957	17600	357			
OFFICE EQUIPMENT																							
	RADIO SYSTEM	SET	1.00	375	0	6	2250	2250	3	1125	1125	2	750	750	2	750	750	0	0	13	4875	4875	0
	GENERAL EXTENSION EQUIPMENT c/	SET	1.00	83	0	6	498	498	3	249	249	2	166	166	2	166	166	0	0	1079	1079	0	
	SOLAR/WIND CHARGERS	EA	1.00	333	0	6	1998	1998	3	999	999	2	666	666	2	666	666	0	0	13	4329	4329	0
	FURNITURE REPLACEMENT	SET	1.00	250	0	6	1500	1500	3	750	750	2	500	500	2	500	500	0	0	13	3250	3250	0
SUB TOTAL				0	6246	6246		3123	3123	2082	2082	2082	2082	0	0	0	0	13533	13533	0			
TOTAL				5000	83392	78775		49069	45024	31308	27900	54413	51895	18509	16512	15619	13882	252310	233987	18324			
TOTAL FOREIGN EXCHANGE						78775		45024		27900		51895		16512		13882		233987					
TOTAL LOCAL CURRENCY						4617		4046		3408		2519		1998		1737		18324					
ADJUSTED TOTAL (1/1/88 PRICES)						86679		51229		32827		56474		19404		16383		262994					
PHYSICAL CONTINGENCIES						6848		3586		2298		3953		1358		1147		18410					
TOTAL COST						92746		54815		35124		60427		20762		17530		281404					
ECONOMIC COST						87797		51249		32442		57440		19185		16173		264286					

a/ INCLUDES WATER STORAGE TANKS.

b/ REFER TABLE A7.7.

c/ HALF WITH FRONT END LOADING BUCKETS.

d/ INCLUDES TENTS, COOKING UTENSILS, ETC. SUFFICIENT FOR 5 PEOPLE PER SET. SOME SETS ON HAND FROM PHASE I.

e/ FLIP CHARTS, POSTERS, PAMPHLETS ETC.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.11 : RECURRENT COSTS, FIELD SERVICES

FSRFE			UNIT COST		YEAR PPF	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL				
	ITEM	UNIT	(%)	SS'000	NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL
STAFF (TABLE A7.4)		YR	0	VAR	0	1 24060	0	1 27540	0	1 29453	0	1 34806	0	1 38177	0	1 40647	0	6 194883	0	194883		
VEHICLE OPERATION & MAINTENANCE a/																						
4 WD (S)	EA	1	155		0	27 4185	4185	34 5270	5270	40 6200	6200	45 6975	6975	50 7750	7750	55 8525	8525	251 38905	38905	0	0	
TRUCKS (INC. EXISTING FLEET)	EA	1	669		0	9 6021	6021	9 6021	6021	9 6021	6021	9 6021	6021	9 6021	6021	9 6021	6021	54 36126	36126	0	0	
TIP TRUCK	EA	1	710		0	1 710	710	1 710	710	1 710	710	1 710	710	1 710	710	1 710	710	6 4260	4260	0	0	
SUB TOTAL					0	10916 10916	12001 12001	12931 12931	13706 13706	14481 14481	15256 15256	79291 79291	0								0	
BUILDING MAINTENANCE b/	YR	0.85	VAR		0	1 2580	2125	1 2500	2125	1 2500	2125	1 2500	2125	1 2500	2125	1 2500	2125	6 15000	12750	2250	0	
TRACTOR OPERATION & MAINTENANCE c/	EA	1	341		0	6 2046	2046	8 2728	2728	10 3410	3410	12 4092	4092	13 4433	4433	13 4433	4433	62 21142	21142	0	0	
CONSTRUCTION EQUIP. OPN & MTCE. d/																						
GRADER	YR	1	1918		0	1 1918	1918	2 3836	3836	2 3836	3836	2 3836	3836	2 3836	3836	2 3836	3836	11 21098	21098	0	0	
DOZER e/	YR	1	2690		0	2 5380	5380	2 5380	5380	2 5380	5380	2 5380	5380	2 5380	5380	2 5380	5380	12 32280	32280	0	0	
LOADER	YR	1	453		0	1 453	453	1 453	453	1 453	453	1 453	453	1 453	453	1 453	453	6 3918	3918	0	0	
TANKS	EA	1	7		0	35 245	245	35 245	245	35 245	245	35 245	245	35 245	245	35 245	245	210 1470	1470	0	0	
SUB TOTAL					0	8196 8196	10114 10114	10114 10114	10114 10114	10114 10114	10114 10114	10114 10114	10114 10114	10114 10114	58766 58766	0					0	
OFFICE EQUIP. MAINTENANCE	YR	1	1000	0.5	500	1 1000	1000	1 1000	1000	1 1000	1000	1 1000	1000	1 1000	1000	1 1000	1000	6 6000	6000	0	0	
OFFICE MATERIALS	YR	0.9	1000	0.5	500	1 1000	900	1 1000	900	1 1000	900	1 1000	900	1 1000	900	1 1000	900	6 6000	5400	600	0	
STAFF UNIFORMS	YR	0.6	900	0.5	450	1 900	540	1 900	540	1 900	540	1 900	540	1 900	540	1 900	540	6 5400	3240	2160	0	
WATER AN ELECTRICITY f/																						
TOOLS AND FIELD SUPPLIES	YR	0.85	1020	0.5	510	1 1020	867	1 1020	867	1 1020	867	1 1020	867	1 1020	867	1 1020	867	6 6120	5202	918	0	
CONSULTANCIES																						
GRADER DRIVING	MM	1	680		0	2 1360	1360	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	2 1360	1360	0	0	
TOTAL					1960	52998 27950	58803 30275	62528 31887	69138 33344	73625 34460	76870 35235	393962 193151	208811									
TOTAL FOREIGN EXCHANGE							27950	30275	31887	33344	34460	35235	193151									
TOTAL LOCAL CURRENCY							25048	28528	30441	35794	39165	41635	208811									
ADJUSTED TOTAL (1/1/88 PRICES)							58846	65416	69612	77297	82491	86254	439918									
PHYSICAL CONTINGENCIES							4119	4579	4873	5411	5774	6038	30794									
TOTAL COST							62965	69996	74486	82708	88266	92292	470713									
ECONOMIC COST							48935	54067	57397	62871	66626	69332	359228									

a/ REFER TABLE A7.7.

b/ FIXED ANNUAL CHARGE AS ADVISED BY CURRENT PROJECT ADMINISTRATION.

c/ HALF WITH FRONT END LOADING BUCKETS. REFER TABLE A7.7.

d/ REFER TABLE A7.7.

e/ 75% OF DOZER FUEL AND RAM CHARGED TO THIS COMPONENT; REMAINDER ALLOCATED TO CONSTRUCTION OF DUGOUTS. REFER TABLE A7.21.

f/ FROM WINDMILLS AND SOLAR POWER.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.12 : INVESTMENT COSTS, RANGE MANAGEMENT

TABLE A/12 : INVESTMENT COSTS, RANGE MANAGEMENT																								
W/H/F/E	ITEM	UNIT	FE (%)	UNIT COST (\$5'800)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL					
					NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE
	FENCED PLOTS (1 HA) a/	PLOT	0.9	70	0	7	490	441	7	490	441	7	490	441	7	490	441	4	280	252	39	2730	2457	273
	TRANSECT MARKERS (1300) b/	M	1	0.42	0	580	210	210	500	210	210	580	210	210	580	210	210	0	0	0	0	2000	840	840
	SUB TOTAL				0	700	651	700	651	700	651	700	651	700	651	490	441	280	252		3570	3297	273	
	SRF/SRRF				0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LANDING STRIPS (INC. IN DOZER OPERATING COSTS)				0	1	4311	4311	0	0	0	0	0	0	0	0	0	0	0	1	4311	4311	0	
	FUEL TANKER	EA	1	4311	0																			
	SUB TOTAL				0	4311	4311	0	0	0	0	0	0	0	0	0	0	0	0		4311	4311	0	
	AGROPASTORAL PRIVATE ENC.STUDY																							
	AERIAL CAMERA	EA	1	1666	1	1666	1666	1666	0	0	0	0	0	0	0	0	0	0	0	1	1666	1666	0	
	COMPUTER SYSTEM (IN RANGE/LIVESTOCK SERV.)				0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	4 WD (L)	EA	1	1245	0	1	1245	1245	0	0	0	0	0	0	0	0	0	0	0	1	1245	1245	0	
	CAMPING SET (INC. IN FIELD SERVICES)				0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	DRYING RACK	EA	0.5	43	0	1	43	22	0	0	0	0	0	0	0	0	0	0	0	1	43	22	22	
	SUB TOTAL				1666	2954	2933	0	0	0	0	0	0	0	0	0	0	0	0		2954	2933	22	
	PASTURE REHAB. AREAS																							
	PASTURE PITTING	EA	1	500	0	1	500	500	0	0	0	0	0	0	0	0	0	0	0	1	500	500	0	
	INITIAL SEED (FROM SEED MULT.)				0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	SUB TOTAL				0	500	500	0	0	0	0	0	0	0	0	0	0	0	0		500	500	0	
	GUTTERING/WATER CONSV.DEMO	EA	1	83	0	2	166	166	2	166	166	2	166	166	1	83	83	0	0	0	0	7	581	581
	VILLAGE SHELTER BELTS																							
	SMALL BERKED (4.5 M3)	EA	0.5	100	0	3	300	150	3	300	150	3	300	150	2	200	100	0	0	0	0	11	1100	
	DONKEY AND CART	UNIT	0.2	20	0	3	60	12	3	60	12	3	60	12	2	40	8	0	0	0	0	11	220	
	SUB TOTAL				0	360	162	360	162	360	162	360	162	240	108	0	0	0	0		1320	594	726	
	TOTAL				1666	8991	8723	1226	979	1226	979	1023	842	490	441	280	252				13236	12216	1021	
	TOTAL FOREIGN EXCHANGE						8723		979		979		842		441		252						12216	
	TOTAL LOCAL CURRENCY						269		247		247		181		49		28						1021	
	ADJUSTED TOTAL (1/1/88 PRICES)						9306		1305		1305		1084		513		293						13807	
	PHYSICAL CONTINGENCIES						651		91		91		76		36		21						966	
	TOTAL COST						9958		1396		1396		1160		549		314						14773	
	ECONOMIC COST						9537		1235		1235		1038		509		291						13846	

a/ ALLOWANCE FOR 3 PLOTS/DISTRICT; TOTAL OF 39 PLOTS. COST INCLUDES LOCAL POSTS AND IMPORTED WIRE, TOOLS AND CEMENT.
b/ ALLOWS FOR 10 TRANSECTS/DISTRICT; 10 PEGS/TRANSECT @ 1.5M/TRANSECT; TOTAL OF 2000M OF STEEL @ US\$5.00/M.

**SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT. PHASE II
TABLE A7.13 : RECURRENT COSTS. RANGE MANAGEMENT**

WIRFE	ITEM	UNIT	FE (%)	UNIT COST (\$\$'000)	YEAR PFF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL										
					NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL				
STAFF (INC. IN TABLE A7.4)	YR	0.00	VAR		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
RANGE MONITORING																													
LAB. ANALYSIS, SOIL SAMPLES a/	YR	1.00		510	0	1	510	510	1	510	510	1	510	510	1	510	510	1	510	510	6	3060	3060	0					
LAB. ANALYSIS, FORAGE SAMPLES b/	YR	1.00		340	0	1	340	340	1	340	340	1	340	340	1	340	340	1	340	340	6	2040	2040	0					
FILMS AND CHEMICALS	YR	1.00		70	0.50	35	1	70	70	1	70	70	1	70	70	1	70	70	1	70	70	6	420	420	0				
SUB TOTAL							35		920	920		920	920		920	920		920	920		5520	5520	0						
CONTRACTS AND CONSULTANCIES																													
FOR FLIGHT PROGRAMS	MM	1.00		850	2	1700	2	1700	1700	0	0		0	0		0	0		0	0	2	1700	1700	0					
DEVEL. PHOTO LAB.	MM	1.00		850	2	1700	2	1700	1700	0	0		0	0		0	0		0	0	2	1700	1700	0					
TRAIN AIR CREW	MM	1.00		1020	2	2040	2	2040	2040	0	0		0	0		0	0		0	0	2	2040	2040	0					
TRAIN DATA ANALYST AND STAFF	MM	1.00		850	2.50	2125	2.50	2125	2125	0	0		0	0		0	0		0	0	3	2125	2125	0					
PRELIN. SURVEY SRF/SRRF	MM	1.00		850	1.50	1275	1.50	1275	1275	0	0		0	0		0	0		0	0	2	1275	1275	0					
FLIGHT CONTRACTS c/																					0								
SRF	HR	1.00		27		0	84	2285	2285	0	0	84	2285	2285	0	0	84	2285	2285	0	0	252	6854	6854	0				
SRF	HR	1.00		27	60	1632	120	3264	3264	120	3264	3264	120	3264	3264	120	3264	3264	120	3264	3264	720	19584	19584	0				
OTHER FLIGHTS d/	HR	1.00		27	120	3264	240	6528	6528	240	6528	6528	240	6528	6528	240	6528	6528	240	6528	6528	1440	39168	39168	0				
SUB TOTAL							13736		20917	20917		9792	9792		12877	12077		9792	9792		12077	12077		9792	9792		74446	74446	0
VEHICLE OPERATION & MTCE. e/																													
FUEL TANKER	YR	1.00		727	0.50	364	1	727	727	1	727	727	1	727	727	1	727	727	1	727	727	6	4362	4362	0				
4 WD (L)	YR	1.00		220	0.50	110	1	220	220	1	220	220	1	220	220	1	220	220	1	220	220	6	1320	1320	0				
SUB TOTAL							474		947	947		947	947		947	947		947	947		947	947		5682	5682	0			
HERBARIUM OPERATION	YR	0.80		300		0	1	300	240	1	300	240	1	300	240	1	300	240	1	300	240	6	1800	1440	360				
CONTINUED OVERLEAF																													

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.13 : RECURRENT COSTS, RANGE MANAGEMENT

NAME ITEM	UNIT	FE COST (%) (\$5'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL				
			NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL
CONTINUED																					
GENERAL LABOUR																					
GUARDS, RANGE CONTROLL GRAZING	4/YR/EA	0.00	140	8 1120	9 1260	0 2 280	0 2 280	0 2 280	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 13 1820	0 1820					
DEVELOP VILLAGE CONSV. AREAS	EA	0.00	24	0 8 192	0 8 192	0 8 192	0 8 192	0 8 192	0 8 192	0 8 192	0 8 192	0 8 192	0 5 120	0 45 1080	0 1080						
SAND DUNE STABILIS'N (2.5 HA)	EA	0.00	15	0 3 45	0 3 45	0 3 45	0 3 45	0 3 45	0 3 45	0 2 30	0 0 0	0 0 0	0 14 210	0 210							
VILLAGE SHELTER BELTS	NO/YR			7	7	7	7	7	7	7	7	7	4	39							
LIVE FENCE 1/	EA	0.00	3	0 7 21	0 7 21	0 7 21	0 7 21	0 7 21	0 7 21	0 7 21	0 7 21	0 4 12	0 39 117	0 117							
GUARDS 1/	YR/EA	0.00	110	0 7 770	0 7 770	0 7 770	0 7 770	0 7 770	0 7 770	0 7 770	0 4 448	0 39 4290	0 4290								
PLANTING COSTS 1/	EA	0.00	18	0 7 126	0 7 126	0 7 126	0 7 126	0 7 126	0 7 126	0 7 126	0 4 72	0 39 702	0 702								
WATERING LABOUR 1/	YR/EA	0.00	83	0 7 581	0 14 1162	0 14 1162	0 14 1162	0 14 1162	0 14 1162	0 14 1162	0 4 332	0 67 5561	0 5561								
SUB TOTAL				1120	2995	0	2596	0	2596	0	2316	0	2301	0	976	0	13780	0 13780			
TOTAL				15365	26079	23024	14555	11899	16840	14184	14275	11899	16545	14184	12935	11899	101228	87888	14140		
TOTAL FOREIGN EXCHANGE						23024	11899	14184	11899	14184	11899	87088									
TOTAL LOCAL CURRENCY						3055	2656	2656	2376	2361	1036	14140									
ADJUSTED TOTAL (1/1/88 PRICES)						27381	15443	17797	15107	17443	13499	106669									
PHYSICAL CONTINGENCIES						1917	1081	1246	1058	1221	945	7467									
TOTAL COST						29297	16524	19042	16165	18663	14444	114136									
ECONOMIC COST						26956	14750	17194	14937	16970	13519	103927									

a/ 200 PER YEAR @ US\$30/SAMPLE.
b/ 200 PER YEAR @ US\$20/SAMPLE.
c/ ESTIMATED FROM COSTS OF SIMILAR SERVICES IN KENYA, PLUS RELOCATION COSTS.
d/ FLIGHTS TO OTHER PARTS OF THE PROJECT AREA.
e/ REFER TABLE A7.7.
f/ 3 GUARDS. 312 DAYS/YEAR EACH @ SS\$150/DAY; AREAS GUARDED FOR TWO CONSECUTIVE YEARS.

g/ EACH 2 KM2. 150M/3ND @ SS150/ND; SS3/M X 8000M; SS24,000 EACH.
h/ 2000M/HA; 2.5 HA; SS3/M; SS15,000 EACH.
i/ 1000M 2SS3/M; SS3,000 EACH.
j/ 2 GUARDS/SHELTER BELT; SS150/DAY; 365 DAYS/YEAR.
k/ 190 X 190 M; 36100 M2; 6000 TREES; 50 TREES/DAY; 120 DAYS; SS150/DAY; SS18,000 EACH.
l/ 3 LABOURERS; WATER 17 TIMES/YEAR; 3.6 HA; 3 DAYS LABOUR/WATERING/HA; SS150/ND; SS93,000/YR EACH.

SOCIAL DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.14 : INVESTMENT AND RECURRENT COSTS, SIMP

TABLE A7.14 : INVESTMENT AND RECURRENT COSTS, SIMP																												
SIMPFE	ITEM	UNIT	FE (%)	UNIT (\$5'000)	YEAR PPF NO.	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL		LOCAL								
						COST NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST		FE	NO.	COST	FE				
	INVESTMENT	EA	1.00	8330		0	2	16660	16660		0	0		0	0		0	0	2	16660	16660	0						
	MOBILE BASE CAMPS	SET	1.00	250		0	6	1500	1500		0	0	3	750	750		0	0	9	2250	2250	0						
	CAMPING EQUIPMENT (5 MAN SET)	SET	1.00	142		0	6	852	852	4	568	568	4	568	568	4	568	568	0	0	22	3124	3124	0				
	GENERAL FIELD EQUIPMENT																											
	VEHICLES - REMOTE SENSING w/ 4 WD (S)	EA	1.00	766		0	1	766	766		0	0	1	766	766		0	0	2	1532	1532	0						
	OFFICE EQUIPMENT																											
	PHOTO INTERPRETATION	SET	1.00	333	1	333	1	333	333		0	0		0	0		0	0	1	333	333	0						
	MAP AND FILING CABINETS	SET	1.00	42	1	42	3	126	126		0	0		0	0		0	0	3	126	126	0						
	TYPEWRITER	EA	1.00	67	2	134	1	67	67		0	0		0	0		0	0	1	67	67	0						
	AUTO WEATHER STATIONS	EA	1.00	725		0	16	11600	11600		0	0		0	0		0	0	16	11600	11600	0						
	LAND SAT IMAGERY	YR	1.00	128	1	128	1	128	128		0	0	1	128	128		0	0	3	384	384	0						
	AERIAL PHOTOGRAPHY	L SUM	1.00	7650	1	7650	1	7650	7650		0	0		0	0		0	0	1	7650	7650	0						
	LARGE SCALE PHOTOS	SET	1.00	1020	1	1020	1	1020	1020		0	0	1	1020	1020		0	0	3	3060	3060	0						
	NOAA AWAAR	VAR	1.00		1	0	1	408	408	1	61	61	1	61	61	1	61	61	1	61	61	6	713	713	0			
	EXISTING AERIAL PHOTOGRAPHY																											
	1960s	SET	1.00	2125	1	2125	1	2125	2125		0	0		0	0		0	0	1	2125	2125	0						
	1970s - 80s	SET	1.00	425	1	425	1	425	425		0	0		0	0		0	0	1	425	425	0						
	EXISTING MOSIACS	SET	1.00	680	1	680	1	680	680		0	0		0	0		0	0	1	680	680	0						
	TOTAL INVESTMENT COSTS					12537		44340	44340		629	629		3293	3293		629	629		1777	1777		61	61	50729	50729	0	
	RECURRENT																											
	MOBILE BASE MAINTENANCE	YR	1.00	833		0	2	1666	1666	2	1666	1666	2	1666	1666	2	1666	1666	2	1666	1666	12	9996	9996	0			
	VEHICLE OPERATION - 4WD (S) w/ OFFICE SUPPLIES	EA	1.00	155		0	1	155	155	1	155	155	1	155	155	1	155	155	1	155	155	6	930	930	0			
	CONSULTANCIES	YR	0.85	83		0	1	83	71	1	83	71	1	83	71	1	83	71	1	83	71	6	498	423	75			
	INSTALL AUTO WEATHER STNS.	MM	1.00	850		0	1	850	850		0	0		0	0		0	0	1	850	850	0						
	ILCA COOPERATION FOR SIMP	MM	1.00	850		0	1	850	850	1	850	850	1	850	850		0	0	3	2550	2550	0						
	METEOROLOGICAL CONSULTANT	MM	1.00	850		0	1	850	850	1	850	850		0	0		0	0	2	1700	1700	0						
	SUB TOTAL					0		2550	2550		1700	1700		850	850		0	0		0	0		5100	5100	0			
	TOTAL RECURRENT COSTS					0		4454	4442		3604	3592		2754	2742		1904	1892		1904	1892		16524	16449	75			
	TOTAL COSTS					12537		48794	48782		4233	4221		6047	6035		2533	2521		3681	3669		1965	1953		67253	67178	75
	TOTAL FOREIGN EXCHANGE							48782			4221		6035		2521					3669			1953			67178		
	TOTAL LOCAL CURRENCY							12			12		12		12					12			12			75		
	ADJUSTED TOTAL (1/1/88 PRICES)							50260			4362		6231		2611					3794			2026			69283		
	PHYSICAL CONTINGENCIES							3518			305		436		183					266			142			4850		
	TOTAL COST							53778			4667		6667		2794					4059			2168			74133		
	ECONOMIC COST							52206			4525		6466		2706					3935			2099			71938		

w/ REFER TABLE A7.7.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.15 : INVESTMENT AND RECURRENT COSTS, RANGE AND LIVESTOCK SERVICES

KLIFE	ITEM	UNIT	FE	COST	UNIT (%)	SS'000	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL								
							NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL		
INVESTMENT																													
VEHICLES (INC. SPARES FOR SHORT TERM CONS.)																													
	4 WD (L) a/	1.00	1245				0	7	8715	8715		0	0		0	0	7	8715	8715		0	0	14	17430	17430	0			
	4 WD (S)	1.00	760				0	5	3830	3830		0	0		0	0	5	3830	3830		0	0	0	0	10	7660	7660	0	
SUB TOTAL							0		12545	12545		0	0		0	0		12545	12545		0	0		0	0	25090	25090	0	
COMPUTER																													
	EA	1.00	417				0	1	417	417		0	0		0	0		0	0		0	0		0	0	1	417	417	0
PHOTOCOPIER																													
	EA	1.00	333				0	1	333	333		0	0		0	0	1	333	333		0	0		0	0	2	666	666	0
TOTAL INVESTMENT COSTS							0		13295	13295		0	0		0	0		12878	12878		0	0		0	0	26173	26173	0	
RECURRENT																													
STAFF (LOCAL) (TABLE A7.3)																													
	YR	0.00	VAR				0	1	5817	0	1	5754	0	1	5868	0	1	5868	0	1	5868	0	1	4524	0	6	33699	0	33699
STAFF (EXPAT) (TABLE A7.3)																													
	YR	1.00	VAR				0	1	29750	29750	1	42500	42500	1	42500	42500	1	42500	42500	1	29750	29750	1	8580	8500	6	195500	195500	0
VEHICLE OPERATION & MAINTENANCE a/																													
	4 WD (L)	YR	1.00	220			0	7	1540	1540	7	1540	1540	7	1540	1540	7	1540	1540	7	1540	1540	7	1540	1540	42	9240	9240	0
	4 WD (S)	YR	1.00	155			0	5	775	775	5	775	775	5	775	775	5	775	775	5	775	775	5	775	775	30	4650	4650	0
SUB TOTAL							0		2315	2315		2315	2315		2315	2315		2315	2315		2315	2315		2315	2315		13890	13890	0
GENERAL OFFICE SUPPLIES																													
	YR	0.90	415				0	1	415	374	1	415	374	1	415	374	1	415	374	1	415	374	1	415	374	6	2490	2241	249
TOTAL RECURRENT COSTS							0		38297	32438		50984	45188		51098	45188		51098	45188		38348	32438		15754	11188		245579	211631	33948
TOTAL COSTS							0		51592	45733		50984	45188		51098	45188		63976	58866		38348	32438		15754	11188		271752	237804	33948
TOTAL FOREIGN EXCHANGE									45733		45188		45188		58866		32438		11188		237804								
TOTAL LOCAL CURRENCY									5859		5796		5910		5910		5910		4566		33948								
ADJUSTED TOTAL (1/1/88 PRICES)									54135		53498		53635		66899		40503		17002		285675								
PHYSICAL CONTINGENCIES									3789		3745		3754		4683		2835		1190		19997								
TOTAL COST									57925		57244		57390		71583		43338		18193		305673								
ECONOMIC COST									53386		52755		52841		66621		39199		15440		280241								

a/ REFER TABLE A7.7.

119

SONALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.16 : INVESTMENT COSTS, EXTENSION

EXT/TYPE	ITEM	UNIT	FE (%)	UNIT COST (SS'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL				
					NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL	
VEHICLES a/																							
	4WD (L)	EA	1.00	1245	0	6	7470	7470	0	0	0	0	6	7470	7470	0	0	0	0	12	14940	14940	0
	4WD BUS	EA	1.00	2874	0	1	2874	2874	0	0	0	0	1	2874	2874	0	0	0	0	2	5748	5748	0
	4WD AUDIO VISUAL	EA	1.00	1916	0	1	1916	1916	0	0	0	0	1	1916	1916	0	0	0	0	2	3832	3832	0
	SCOOTER	EA	1.00	67	0	4	268	268	0	0	0	0	4	268	268	0	0	0	0	8	536	536	0
SUB TOTAL					0	12	12528	12528	0	0	0	0	12	12528	12528	0	0	0	0	25056	25056	0	
EQUIPMENT -DOCUMENTATION CENTRE																							
	COMPUTER (ON HAND) b/	EA			0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	FURNITURE AND SHELVEING	SET	0.85	833	0	1	833	708	0	0	0	0	0	0	0	0	0	0	1	833	708	125	
SUB TOTAL					0	833	708	0	0	0	0	0	0	0	0	0	0	0	0	833	708	125	
EQUIPMENT - DARK ROOM																							
	SET	1.00	833	1	833	1	833	833	0	0	0	0	0	0	0	0	0	0	1	833	833	0	
EQUIPMENT - EXTENSION																							
	COMPUTER	EA	1.00	417	0	1	417	417	0	0	0	0	0	0	0	0	0	0	1	417	417	0	
	TYPEWRITER	EA	1.00	125	0	3	375	375	0	0	0	0	0	0	0	0	0	0	3	375	375	0	
	PHOTOCOPIER (INC IN ADMIN COSTS)	EA			0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	FURNITURE	SET	1.00	417	0	4	1668	1668	0	0	0	0	0	0	0	0	0	0	4	1668	1668	0	
AUDIO VISUAL EQUIPMENT																							
	PRINTING	SET	1.00	417	1	417	1	417	417	0	0	0	0	0	0	0	0	0	1	417	417	0	
	FILM PRODUCTION	SET	1.00	417	1	417	1	417	417	0	0	0	0	0	0	0	0	0	1	417	417	0	
	VIDEO PRODUCTION	SET	1.00	583	1	583	1	583	583	0	0	0	0	0	0	0	0	0	1	583	583	0	
	SLIDE PROCESSING	SET	1.00	417	1	417	1	417	417	0	0	0	0	0	0	0	0	0	1	417	417	0	
SUB TOTAL					1834	4294	4294	0	0	0	0	0	0	0	0	0	0	0	0	4294	4294	0	
TOTAL					2667	18488	18363	0	0	0	0	0	12528	12528	0	0	0	0	0	31016	30891	125	
TOTAL FOREIGN EXCHANGE							18363	0	0	0	0	12528	0	0	0	0	0	0	30891				
TOTAL LOCAL CURRENCY							125	0	0	0	0	0	0	0	0	0	0	125					
ADJUSTED TOTAL (1/1/88 PRICES)							19064	0	0	0	12904	0	0	0	0	0	31968						
PHYSICAL CONTINGENCIES							1334	0	0	0	903	0	0	0	0	0	2238						
TOTAL COST							20398	0	0	0	13807	0	0	0	0	0	34205						
ECONOMIC COST							19743	0	0	0	13405	0	0	0	0	0	33148						

a/ REFER TABLE A7.7.

b/ A 20 MEGABYTE COMPUTER ON HAND AT THE START OF THE PROJECT WOULD BE USED IN THE DOCUMENTATION CENTRE. OR SUBSTITUTED.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.17 : RECURRENT COSTS, EXTENSION

EXTRFE		UNIT	YEAR PPF	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL		
ITEM	FE	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL
	UNIT	(%)	(\$5'000)	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.17 : RECURRENT COSTS, EXTENSION

EXTRFE	ITEM	UNIT	FE (%)	UNIT COST (\$5'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL								
					NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL		
	STAFFING (LOCAL) (TABLE A7.5)	VAR	0.00		0	1	2835	0	1	2835	0	1	2835	0	1	2835	0	1	2583	0	1	2583	0	6	16506	0	16506
	STAFFING (EXPAT) (TABLE A7.5)	YR	1.00	8500	0	1	8500	8500	1	8500	8500	1	8500	8500	1	8500	8500	1	8500	8500	1	8500	8500	6	51000	31000	0

VEHICLE OPERATION & MAINTENANCE ✓

VEHICLE OPERATING & MAINTENANCE																								
4WD (L)	YR	1.00	220	3	660	6	1320	1320	6	1320	1320	6	1320	1320	6	1320	1320	6	1320	1320	36	7920	7920	0
4WD (S)	YR	1.00	155		0		0	0		0	0		0	0		0	0		0	0	0	0	0	0
4WD BUS	YR	1.00	442		0	1	442	442	1	442	442	1	442	442	1	442	442	1	442	442	6	2652	2652	0
SCOOTER	YR	1.00	14		0	4	56	56	4	56	56	4	56	56	4	56	56	4	56	56	24	336	336	0
4WD AUDIO VISUAL	YR	1.00	295	2	590	1	295	295	1	295	295	1	295	295	1	295	295	1	295	295	6	1770	1770	0
SUB TOTAL						1250	2113	2113		2113	2113		2113	2113		2113	2113		2113	2113		12678	12678	0

EQUIPMENT MAINTENANCE & SUPPLIES

EQUIPMENT MAINTENANCE & SUPPLIES																											
COMPUTER OPERATION SUPPLIES	YR	1.00	333	0.5	167	1	333	333	1	333	333	1	333	333	1	333	333	1	333	333	1	333	333	6	1998	1998	0
DARK ROOM SUPPLIES	YR	1.00	417	0.5	209	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	6	2502	2502	0
DOCUMENTATION CENTRE SUPPLIES	YR	1.00	417		0	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	6	2502	2502	0
GENERAL SUPPLIES	YR	0.90	250		0	1	250	225	1	250	225	1	250	225	1	250	225	1	250	225	1	250	225	6	1500	1350	150
CONTRACT PRINTING	YR	0.85	570	1	570	1	570	485	1	570	485	1	570	485	1	570	485	1	570	485	1	570	485	7	3420	2907	513
AUDIO VISUAL SUPPLIES																											
PRINTING, COPYING & BINDING	YR	0.85	833	0.5	417	1	833	708	1	833	708	1	833	708	1	833	708	1	833	708	1	833	708	6	4998	4248	750
VIDEO FILMS	YR	1.00	265	0.5	133	1	265	265	1	265	265	1	265	265	1	265	265	1	265	265	1	265	265	6	1590	1590	0
16 MM FILM	YR	1.00	431	0.5	216	1	431	431	1	431	431	1	431	431	1	431	431	1	431	431	1	431	431	6	2586	2586	0
SLIDES	YR	1.00	265	0.5	133	1	265	265	1	265	265	1	265	265	1	265	265	1	265	265	1	265	265	6	1590	1590	0
FLIP CHARTS, MAPS ETC.	YR	1.00	265	0.5	133	1	265	265	1	265	265	1	265	265	1	265	265	1	265	265	1	265	265	6	1590	1590	0
OTHER FILM (INC. SAMP FILM)	YR	1.00	417	0.5	209	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	6	2302	2302	0
SUB TOTAL					2183		4463	4228		4463	4228		4463	4228		4463	4228		4463	4228		4463	4228		26778	25365	1413

EXTENSION TRAINING EQUIPMENT & MATERIALS

BOOKS, JOURNALS ETC.	YR	1.00	823		0	1	823	823	1	823	823	1	823	823	1	823	823	1	823	823	1	823	823	6	4938	4938	0
16 MM FILMS	YR	1.00	167		0	1	167	167	1	167	167	1	167	167	1	167	167	1	167	167	1	167	167	6	1002	1002	0
VIDEOS	YR	1.00	167		0	1	167	167	1	167	167	1	167	167	1	167	167	1	167	167	1	167	167	6	1002	1002	0
SLIDE SETS	YR	1.00	167		0	1	167	167	1	167	167	1	167	167	1	167	167	1	167	167	1	167	167	6	1002	1002	0
FILM STRIPS	YR	1.00	167		0	1	167	167	1	167	167	1	167	167	1	167	167	1	167	167	1	167	167	6	1002	1002	0
					0		1491	1491		1491	1491		1491	1491		1491	1491		1491	1491		1491	1491		8946	8946	0

CONTINUED OVERLEAF

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.17 : RECURRENT COSTS, EXTENSION

TABLE A/17: RECURRENT COSTS: EXTENSION																											
EXTRFE	ITEM	UNIT	FE (%)	UNIT COST (\$5'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL								
					NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL		
CONTINUED																											
SUPPORT FOR DEVELOPMENT INTERVENTIONS																											
	SUPPORT FOR RLAs b/ c/	YR	0.00	VAR	0	1	3400	0	1	3825	0	1	4250	0	1	4675	0	1	5100	0	6	25500	0	25500			
	DEMONSTRATIONS OF INTERVENTIONS	YR	0.00	1700	0	1	1700	0	1	1700	0	1	1700	0	1	1700	0	1	1700	0	6	10200	0	10200			
	RURAL DEVELOPMENT	YR	0.00	1700	0	1	1700	0	1	1700	0	1	1700	0	1	1700	0	1	1700	0	6	10200	0	10200			
	ENTERPRISE DIVERSIFICATION	YR	0.00	850	0	1	850	0	1	850	0	1	850	0	1	850	0	1	850	0	6	5100	0	5100			
SUB TOTAL					0		7450	0		8075	0		8500	0		8925	0		9350	0		51000	0	51000			
TRAINING (COSTS ADDITIONAL TO PER DIEMS. ETC.)																											
	SEMINARS	YR	0.30	245	0.5	123	1	245	74	1	245	74	1	245	74	1	245	74	1	245	74	6	1470	441	1029		
	WORKSHOPS	YR	0.30	245	0.5	123	1	245	74	1	245	74	1	245	74	1	245	74	1	245	74	6	1470	441	1029		
	MEETINGS	YR	0.10	245	0.5	123	1	245	25	1	245	25	1	245	25	1	245	25	1	245	25	6	1470	147	1323		
	FIELD DAYS	YR	0.10	245	0.5	123	1	245	25	1	245	25	1	245	25	1	245	25	1	245	25	6	1470	147	1323		
SUB TOTAL					490		980	196		980	196		980	196		980	196		980	196		5880	1176	4704			
CONSULTANCIES																											
	PASTORAL ANTHROPOLOGIST	MM	1.00	850	0	12	10200	10200	6	5100	5100	0	0	0	0	0	0	0	0	18	15300	15300	0	0			
	EXTENSION, EDUCATION & TRAINING	MM	1.00	850	0	1	850	850	1	850	850	1	850	850	0	0	0	0	0	0	3	2550	2550	0	0		
	RURAL CREDIT STUDY	MM	1.00	850	0	3	2550	2550	0	0	0	0	0	0	0	0	0	0	0	0	2	1700	1700	0	0		
	AUDIO VISUAL TRAINING	MM	1.00	850	0	2	1700	1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
SUB TOTAL					0		15300	15300		5950	5950		850	850		0	0		0	0		22100	22100	0	0		
TOTAL					3923		43332	31828		34407	22478		29732	17378		28882	16528		29055	16528		29480	16528		194888	121245	73623
TOTAL FOREIGN EXCHANGE								31827		22477		17377		16527		16527		16527		121245							
TOTAL LOCAL CURRENCY								11504		11929		12354		12354		12527		12952		73623							
ADJUSTED TOTAL (1/1/88 PRICES)								46587		37467		32724		31848		32056		32566		213250							
PHYSICAL CONTINGENCIES								3261		2623		2291		2229		2244		2280		14928							
TOTAL COST								49849		40090		35015		34078		34300		34846		228178							
ECONOMIC COST								42795		33114		27980		27070		27202		27524		185685							

a/ REFER TABLE A7.7.

b/ 120 RLAs, EACH PAID \$50.2125 MILLION DURING PERIOD OF SUPPORT.

c/ LUMP SUM OF \$525.5 MILLION REDUCED BY \$98.0 MILLION TO REFLECT SUPPORT FOR CAMEL-RELATED ACTIVITIES IN OTHER COMPONENTS.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.16 : INVESTMENT COSTS, AGROPASTORAL

AGIFE			UNIT		YEAR PPF	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL	
	ITEM	FE	COST																
		UNIT	(%)	(SS'000)	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE
BUILDINGS (MAINLY LOCAL MATERIALS)																			
ADAPTIVE TRIALS NOOLEEYE																			
	STORE	M2	0.70	10	90	908	98	900	630	0	0	0	0	0	0	0	0	90	900
	WORKSHOP/LAB	M2	0.70	17	150	2550	150	2550	1785	0	0	0	0	0	0	0	0	150	2550
	SHELTER	M2	0.70	5	100	500	100	500	350	0	0	0	0	0	0	0	0	100	500
	OFFICE	M2	0.70	13	100	1300	100	1300	910	0	0	0	0	0	0	0	0	100	1300
	2 BR HOUSE (2) (50M2 EA)	M2	0.70	12	100	1200	100	1200	840	0	0	0	0	0	0	0	0	100	1200
	SINGLE QUARTERS (2) (70M2 EA)	M2	0.70	12	140	1680	140	1680	1176	0	0	0	0	0	0	0	0	140	1680
	BUSH SHELTER	EA	0.40	170	1	170	1	170	68	0	0	0	0	0	0	0	0	1	170
	WATER SUPPLY	SET	1.00	425	1	425	1	425	425	0	0	0	0	0	0	0	0	1	425
ADAPTIVE TRIALS BULO BURT																			
	STORE	M2	0.70	10		0	90	900	630	0	0	0	0	0	0	0	0	90	900
	WORKSHOP/LAB	M2	0.70	17		0	150	2550	1785	0	0	0	0	0	0	0	0	150	2550
	SHELTER	M2	0.70	5		0	100	500	350	0	0	0	0	0	0	0	0	100	500
	OFFICE	M2	0.70	13		0	100	1300	910	0	0	0	0	0	0	0	0	100	1300
	2 BR HOUSE (2) (50M2 EA)	M2	0.70	12		0	100	1200	840	0	0	0	0	0	0	0	0	100	1200
	SINGLE QUARTERS (2) (70M2 EA)	M2	0.70	12		0	140	1680	1176	0	0	0	0	0	0	0	0	140	1680
	BUSH SHELTER	EA	0.70	170		0	1	170	119	0	0	0	0	0	0	0	0	1	170
	HUT	M2	0.40	5		0	40	200	80	0	0	0	0	0	0	0	0	40	200
	WATER SUPPLY	SET	1.00	425		0	1	425	425	0	0	0	0	0	0	0	0	1	425
BULO BURT SEED MULTIPLICATION																			
	2 BR HOUSES (2) (50M2 EA)	M2	0.85	15	100	1500	100	1500	1275	0	0	0	0	0	0	0	0	100	1500
	1 BR HOUSES (4) (40M2 EA)	M2	0.85	15	160	2400	160	2400	2040	0	0	0	0	0	0	0	0	160	2400
	TRACTOR & IMPL. SHED	M2	0.85	13	150	1950	150	1950	1658	0	0	0	0	0	0	0	0	150	1950
	WORK AREA	M2	0.85	13	100	1300	100	1300	1105	0	0	0	0	0	0	0	0	100	1300
	OFFICE AND ABLUTIONS	M2	0.85	17	100	1700	100	1700	1445	0	0	0	0	0	0	0	0	100	1700
	GENERAL STORE	M2	0.85	13	90	1170	90	1170	995	0	0	0	0	0	0	0	0	90	1170
	SEED STORAGE SHED	M2	0.85	13	90	1170	90	1170	995	0	0	0	0	0	0	0	0	90	1170
	POWER & WATER CONNECTION	SET	1.00	425	1	425	1	425	425	0	0	0	0	0	0	0	0	1	425
	CLEAR, LEVEL, BUILD CHANNELS	L	SUN 0.85	425	1	425	1	425	361	0	0	0	0	0	0	0	0	1	425
SUB TOTAL						20765		29690	22797	0	0	0	0	0	0	0	0	29690	22797
VEHICLES &																			
	HEAD QUARTERS - 4WD (L)	EA	1.00	1245		0	3	3735	3735	0	0	0	0	3	3735	3735	0	0	4
	- SCOOTER	EA	1.00	67		0	2	134	134	0	0	0	0	2	134	134	0	0	4
	ADAPTIVE TRIALS - 4WD (L)	EA	1.00	1245		0	3	3735	3735	0	0	0	0	3	3735	3735	0	0	4
	- MOTOR BIKE	EA	1.00	239		0	2	478	478	0	0	0	0	2	478	478	0	0	4
	BULO BURT - 4WD (L)	EA	1.00	1245		0	1	1245	1245	0	0	0	0	1	1245	1245	0	0	2
	- MOTOR BIKE	EA	1.00	239		0	2	478	478	0	0	0	0	2	478	478	0	0	4
SUB TOTAL						0		9805	9805	0	0	0	0	9805	9805	0	0	0	0
PLANT AND EQUIPMENT																			
	HEAD QUARTERS																		
	2-WAY RADIO	SET	1.00	417		0	1	417	417	0	0	0	0	0	0	0	0	0	1
	COMPUTER	EA	1.00	417		0	1	417	417	0	0	0	0	0	0	0	0	0	1
	TYPEWRITER	EA	1.00	125		0	2	250	250	0	0	0	0	0	0	0	0	2	250
	ADAPTIVE TRIALS - NOOLEEYE																		
	GENERATOR	EA	1.00	250		0	1	250	250	0	0	0	0	0	0	0	0	0	1

CONTINUED OVERLEAF

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.18 : INVESTMENT COSTS, AGROPASTORAL

AGIFE	ITEM	UNIT	FE (%)	UNIT COST (SS'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL						
					NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST		
																								FE	LOCAL
CONTINUED																									
BURLO BURT1 SEED MULTIPLICATION																									
	TRACTOR AND TRAILER	EA	1.00	1198	1	1198	1	1198	1198	0	0	0	0	0	0	0	0	0	0	1	1198	1198	0		
	CULTIVATION EQUIPMENT	SET	1.00	583	1	583	1	583	583	0	0	0	0	0	0	0	0	0	0	1	583	583	0		
	LEVELLER	EA	1.00	167	1	167	1	167	167	0	0	0	0	0	0	0	0	0	0	1	167	167	0		
	SPRAY EQUIPMENT	SET	1.00	250	1	250	1	250	250	0	0	0	0	0	0	0	0	0	0	1	250	250	0		
	FERTILISER EQUIPMENT	EA	1.00	250	1	250	1	250	250	0	0	0	0	0	0	0	0	0	0	1	250	250	0		
	FENCING	L SUM	1.00	500	1	500	1	500	500	0	0	0	0	0	0	0	0	0	0	1	500	500	0		
	IRRIGATION PUMP & EQUIP	SET	1.00	2499	1	2499	1	2499	2499	0	0	0	0	0	0	0	0	0	0	1	2499	2499	0		
	SAMPLE GRINDERS	SET	1.00	42	1	42	1	42	42	0	0	0	0	0	0	0	0	0	0	1	42	42	0		
	SEED CLEANER	EA	1.00	417	1	417	1	417	417	0	0	0	0	0	0	0	0	0	0	1	417	417	0		
	SET OF SIEVES	SET	1.00	167	1	167	1	167	167	0	0	0	0	0	0	0	0	0	0	1	167	167	0		
	CEMENT MIXER	EA	1.00	83	1	83	1	83	83	0	0	0	0	0	0	0	0	0	0	1	83	83	0		
	SCARIFYING EQUIPMENT	SET	1.00	250	1	250	1	250	250	0	0	0	0	0	0	0	0	0	0	1	250	250	0		
	MOISTURE CONTROL EQUIPMENT	SET	1.00	417	1	417	1	417	417	0	0	0	0	0	0	0	0	0	0	1	417	417	0		
	SEED TEST ROOM EQUIP.	SET	1.00	1733	1	1733	1	1733	1733	0	0	0	0	0	0	0	0	0	0	1	1733	1733	0		
	CUPBOARDS AND BENCHES	SET	0.50	170	1	170	1	170	85	0	0	0	0	0	0	0	0	0	0	1	170	85	85		
	SUNDRY TOOLS ETC.	SET	0.70	417	1	417	1	417	292	0	0	0	0	0	0	0	0	0	0	1	417	292	125		
SUB TOTAL						9143		10477	10267	0	0	0	0	0	0	0	0	0	0		10477	10267	210		
MATERIAL SUPPLIES. ADAPTIVE TRIALS																									
	FENCING MATERIALS	L SUM	1.00	500	0.50	250	1	500	500	0	0	1	500	500	0	0	0	0	0	2	1000	1000	0		
	TOOLS AND LIGHT IMPLMENTS	SET	0.70	550	0.50	275	1	550	385	1	550	385	1	550	385	1	550	385	0	0	4	2200	1540	660	
	SEED	L SUM	1.00	833	0.50	417	1	833	833	1	833	833	1	833	833	0	0	0	0	3	2499	2499	0		
	FERTILISER	L SUM	1.00	833	0.50	417	1	833	833	1	833	833	0	0	0	0	0	0	0	2	1666	1666	0		
	UNSPECIFIED. INC. COMPENSATION	L SUM	0.50	425	0.50	213	1	425	213	1	425	213	1	425	213	1	425	213	0	0	4	1700	850	850	
SUB TOTAL						1571		3141	2764	2641	2264	2308	1931	975	598	0	0	0	0		9065	7555	1510		
VILLAGE TREE PLANTING INC. IN NURSERIES																									
	INNOVATIONS AND INCENTIVES	EA	0.00	85		0	10	850	0	20	1700	0	30	2550	0	40	3400	0	50	4250	0	60	5100	0	17850
	ASSISTANCE TO APCs & OTHER	YR	0.00	425		0	1	425	0	1	425	0	1	425	0	1	425	0	1	425	0	6	2550	0	2550
SUB TOTAL						0		1275	0	2125	0	2975	0	3825	0	4675	0	5525	0		20400	0	20400		
TOTAL						31479		54388	45632	4766	2264	5283	1931	14605	10403	4675	0	5525	0		89242	60229	29013		
TOTAL FOREIGN EXCHANGE									45632	2264		1931		10403		0		0		60229					
TOTAL LOCAL CURRENCY									8756	2503		3353		4203		4675		5525		29013					
ADJUSTED TOTAL (1/1/88 PRICES)									57508	5334		6011		15758		5610		6630		96852					
PHYSICAL CONTINGENCIES									4026	373		421		1103		393		464		6780					
TOTAL COST									61534	5708		6432		16861		6003		7894		103631					
ECONOMIC COST									55478	4323		4613		14323		3552		4197		86486					

✓ REFER TABLE A7.7.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL HANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.19 : RECURRENT COSTS, AGROPASTORAL

AGRI	ITEM	UNIT	FE (%)	UNIT COST (\$5'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL						
					NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL
	STAFF COSTS-LOCAL (TABLE A7.6)	YR	0.00	2579	0	1	2579	0	1	2579	0	1	2579	0	1	2579	0	1	2579	0	6	15474	0	15474	
	STAFF COSTS-EXRAT (TABLE A7.6)	YR	1.00	8500	0	1	8500	8500	1	8500	8500	1	8500	8500	1	8500	8500	1	8500	8500	6	51000	51000	0	
	BUILDING MAINTENANCE a/	YR	0.85	459	0.50	230	1	459	390	1	459	390	1	459	390	1	459	390	1	459	390	6	2754	2341	413
	HOUSE RENTAL (VISITING STAFF)	YR	0.00	170		1	170	0	1	170	0	1	170	0	1	170	0	1	170	0	6	1020	0	1020	
	VEHICLE OPERATION AND MTCE. b/																								
	4WD (L)	YR	1.00	220	0.50	110	7	1540	1540	7	1540	1540	7	1540	1540	7	1540	1540	7	1540	1540	42	9240	9240	0
	4WD (S)	YR	1.00	155		0		0	0		0	0		0	0		0	0		0	0	0	0	0	0
	MOTOR BIKE	YR	1.00	49	1.00	49	4	196	196	4	196	196	4	196	196	4	196	196	4	196	196	24	1176	1176	0
	SCOOTER	YR	1.00	14		0	2	28	28	2	28	28	2	28	28	2	28	28	2	28	28	12	168	168	0
	TRACTOR AND TRAILOR	YR	1.00	328	0.50	164	1	328	328	1	328	328	1	328	328	1	328	328	1	328	328	6	1968	1968	0
	SUBTOTAL					323		2092	2092		2092	2092		2092	2092		2092	2092		2092	2092		12552	12552	0
	PLANT AND EQUIP. MAINTENANCE c/	YR	1.00	1048	0.50	524	1	1048	1048	1	1048	1048	1	1048	1048	1	1048	1048	1	1048	1048	6	6288	6288	0
	PLANT AND SOIL ANALYSIS d/	YR	1.00	850	0.50	425	1	850	850	1	850	850	1	850	850	1	850	850	1	850	850	6	5100	5100	0
	CONTRACT SEED PRODUCTION e/	YR	0.00	850	0.50	425	1	850	0	1	850	0	1	850	0	1	850	0	1	850	0	6	5100	0	5100
	REPLACEMENT SEED SUPPLIES	YR	1.00	417	0.50	209	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	6	2502	2502	0
	REPLACEMENT CHEMICALS	YR	1.00	417	0.50	209	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	6	2502	2502	0
	REPLACEMENT FERTILISER	YR	1.00	417	0.25	104	1	417	417	1	417	417	1	417	417	1	417	417	1	417	417	6	2502	2502	0
	NURSERY OPERATION																					0			
	MATERIALS	YR	0.30	333	0.50	167	1	333	100	1	333	100	1	333	100	1	333	100	1	333	100	6	1998	599	1399
	LABOUR f/	EA/YR	0.00	140	3.00	420	6	840	0	9	1260	0	13	1820	0	13	1820	0	13	1820	0	67	9380		9380
	SUB TOTAL					1533		3274	1351		3694	1351		4254	1351		4254	1351		4254	1351		23984	8105	15879
																									CONTINUED OVERLEAF

CONTINUED OVERLEAF

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.19 : RECURRENT COSTS, AGROPASTORAL

AGRFE			UNIT	YEAR PPF	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	TOTAL													
	FE	COST																						
ITEM	UNIT	(%)	(SS'000)	NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL			
												CONTINUED OVERLEAF												
CONTINUED																								
CONSULTANCIES																								
ANIMAL TRACTION	MM	1.00	850		0		0		1	850	850		0	0		0	0		0	0	1	850	850	0
ARID LAND FORESTER	MM	1.00	850		0	1	850	850	1	850	850		0	0		0	0		0	0	3	2550	2550	0
AGRONOMIST	MM	1.00	850	3	2550	3	2550	2550		0	0	1	850	850		0	0		0	0	4	3400	3400	0
IRRIGATION	MM	1.00	850	1	850	1	850	850		0	0		0	0		0	0		0	0	1	850	850	0
SOIL SCIENTIST	MM	1.00	850	2	1700	2	1700	1700		0	0	1	850	850		0	0		0	0	3	2550	2550	0
PRIVATE ENCLOSURE STUDY		1.00																						
GEOGRAPHER	MM	1.00	850	3	2550	3	2550	2550		0	0		0	0		0	0		0	0	3	2550	2550	0
ANTHROPOLOGIST/SOCIO ECS.	MM	1.00	850	3	2550	3	2550	2550		0	0		0	0		0	0		0	0	3	2550	2550	0
REMOTE SENSING SPECIALIST	MM	1.00	850	2	1700	2	1700	1700		0	0		0	0		0	0		0	0	2	1700	1700	0
LOCAL CONTRACT STAFF	L SUM	1.00	300	1	300	1	300	300		0	0		0	0		0	0		0	0	1	300	300	0
MAPS AND PRINTING	SET	0.70	425	1	425	1	425	298		0	0		0	0		0	0		0	0	1	425	298	128
OTHER LOCAL CONTRACT STAFF	L SUM	1.00	150	1	150	1	150	150		0	0		0	0		0	0		0	0	1	150	150	0
SUB TOTAL					12775		13625	13498		1700	1700		2550	2550		0	0		0	0		17875	17748	128
TOTAL					15809		32597	27729		21092	15931		22502	16781		19952	14231		19952	14231		136047	103134	32913
TOTAL FOREIGN EXCHANGE								27729			15931			16781			14231			14231			103134	
TOTAL LOCAL CURRENCY								4868			5161			5721			5721			5721			32913	
ADJUSTED TOTAL (1/1/88 PRICES)								34402			22602			24149			21523			21523			145723	
PHYSICAL CONTINGENCIES								2408			1582			1690			1507			1507			10201	
TOTAL COST								36811			24184			25849			23030			23030			155924	
ECONOMIC COST								33368			20967			22302			19573			19573			135357	

a/ 2% OF INVESTMENT COSTS.
b/ REFER TABLE A7.7.
c/ 10% OF INVESTMENT COSTS.

d/ 400 SAMPLES/YEAR 2 AVERAGE OF US\$ 30.00/SAMPLE.
e/ BY LOCAL AGROPASTORALISTS.
f/ 3 LABOURERS/NURSERY 2 SS150/DAY; 312 DAYS/YEAR; TOTAL/NURSERY, SS140,000.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.20 : INVESTMENT AND RECURRENT COSTS, LIVESTOCK PRODUCTION

LSPFE			UNIT	YEAR PFF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL								
ITEM	UNIT	FE (%)	COST (\$S'000)	NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL					
INVESTMENT																										
PURCHASE OF GOATS/SHEEP A/	YR	0.00	850	0	1	850	0	0	0	1	850	0	2	1700	0	2	1700	0	2	1700	0	6800				
GENERAL LIVESTOCK EQUIPMENT B/	YR	0.85	833	0	2	1666	1416	1	833	708	1	833	708	1	833	708	1	833	708	7	5831	4956	875			
CAMEL RIDING DEMONSTRATIONS C/																										
CAMELS	EA	0.00	85	0	16	1360	0	0	0	0	0	0	0	0	0	0	0	0	16	1360	0	1360				
CAMEL SADDLES (PURCHASED)	EA	1.00	32	0	8	256	256	0	0	0	0	0	0	0	0	0	0	0	8	256	256	0				
CAMEL SADDLES (MANUFACTURED)	EA	0.30	21	0	8	168	50	0	0	0	0	0	0	0	0	0	0	0	8	168	50	118				
CAMEL SCOOP DEMONSTRATION																										
CAMELS	EA	0.00	85	0	30	2550	0	0	0	0	0	0	0	0	0	0	0	0	30	2550	0	2550				
SCOOPS	EA	1.00	43	0	15	645	645	0	0	0	0	0	0	0	0	0	0	0	15	645	645	0				
DRAFT ANIMAL TRIALS																										
CAMELS/DONKEYS (4 OF EACH)	L SUM	0.00	510	0	1	510	0	0	0	0	0	0	0	0	0	0	0	0	1	510	0	510				
PLOUGHS AND IMPLEMENTS	SET	1.00	85	0	1	85	85	0	0	0	0	0	0	0	0	0	0	0	1	85	85	0				
CAMELS (31) (MILKING HERD)	EA	0.00	143	0	31	4433	0	0	0	0	0	0	0	0	0	0	0	0	31	4433	0	4433				
CAMEL AND DONKEY CARTS	SET	0.30	85	0	2	170	51	2	170	51	0	0	0	0	0	0	0	0	4	340	102	238				
TOTAL INVESTMENT				0		12693	2504		1003	759		1683	708		2533	708		2533	708		22978	6095	16883			
RECURRENT																										
ONGOING VETERINARY COSTS A/																										
DRUGS, ETC. FOR REVOLVING FUND	YR	1.00	850	0	0	0	0	0	0	0	0	1	850	850	1	850	850	1	850	850	3	2550	2550	0		
LABORATORY OPERATING COSTS	YR	1.00	1700	0	0	0	0	0	0	0	0	1	1700	1700	1	1700	1700	1	1700	1700	3	5100	5100	0		
OP. COSTS FOR 2 VET. TEAMS				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
VEHICLE OPERATION	YR	1.00	220	0	0	0	0	0	0	0	0	2	440	440	2	440	440	2	440	440	6	1320	1320	0		
SALARIES & PER DIEMS	YR	0.00	108	0	0	0	0	0	0	0	0	3	324	0	3	324	0	3	324	0	9	972	0	972		
DRIVERS	YR	0.00	63	0	0	0	0	0	0	0	0	2	126	0	2	126	0	2	126	0	6	378	0	378		
OPERATIONAL MATERIALS	YR	0.85	170	0	0	0	0	0	0	0	0	1	170	145	1	170	145	1	170	145	3	510	434	77		
SUB TOTAL				0		0	0		0	0		0	0		3610	3135		3610	3135		3610	3135		10830	9404	1427
CONSULTANCIES AND STUDIES																										
CAMEL RIDING & CAMEL USE	MM	1.00	850	0	3	2550	2550	0	0	0	0	0	0	0	0	0	0	0	3	2550	2550	0	0			
DUSOUT SCOOP	MM	1.00	850	0	2	1700	1700	0	0	0	0	0	0	0	0	0	0	0	2	1700	1700	0	0			
RURAL CREDIT STUDY	MM	1.00	850	0	3	2550	2550	0	0	0	0	0	0	0	0	0	0	0	3	2550	2550	0	0			
STUDY OF RLAs (ANTHROPOLOGIST)	MM	1.00	850	2	1700	3	2550	2550	0	0	0	0	0	0	0	0	0	0	3	2550	2550	0	0			
LOCAL SUPPORT (LAWYERS)	TOTAL	0.00	150	1	150	1	150	0	0	0	0	0	0	0	0	0	0	0	1	150	0	150	0			
REPORT PREPARATION	L SUM	0.85	50	1	50	1	50	43	0	0	0	0	0	0	0	0	0	0	1	50	43	0	0			
MILK UTILISATION STUDY	MM	1.00	850	0	0	0	0	3	2550	2550	0	0	0	0	0	0	0	0	3	2550	2550	0	0			
ILCA, RAPID HERD APPRAISAL	MM	1.00	850	6	5100	6	5100	5100	0	0	0	0	0	0	0	0	0	0	6	5100	5100	0	0			
ASSISTANCE, ILCA COMPUTER	YR	1.00	142	0	1	142	142	1	142	142	1	142	142	1	142	142	1	142	142	6	852	852	0			
SUB TOTAL				7000		14792	14635		2692	2692		142	142		142	142		142	142		18952	17895	158			
CONTINUED OVERLEAF																										

CONTINUED OVERLEAF

127

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.20 : INVESTMENT AND RECURRENT COSTS, LIVESTOCK PRODUCTION

LSP/FE	UNIT	FE COST	YEAR PPF	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	TOTAL	
ITEM	UNIT (%)	(SS'000)	NO. COST	NO. COST	FE NO. COST	FE NO. COST	FE NO. COST	FE NO. COST	FE NO. COST	FE NO. COST	FE NO. COST
MAINTENANCE OF PROJECT-PURCHASED CAMELS (FOODER)											
MILKING HERD CAMELS (FREE, GRAZED BY TRAIL HERDERS)											
RIDING CAMELS	EA/YR 0.00	41	0 16 656	0 16 656	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	32 1312	0 1312
CAMEL SCOOP CAMELS	EA/YR 0.00	41	0 30 1230	0 30 1230	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	60 2460	0 2460
SUB TOTAL			0 1886	0 1886	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	3772	0 3772
TOTAL RECURRENT			16678 14635	4578 2692	142 142	3752 3277	3752 3277	3752 3277	3752 3277	32654 27298	5356
TOTAL			29371 17138	5581 3451	1825 850	6285 3985	6285 3985	6285 3985	6285 3985	55632 33393	22239
TOTAL FOREIGN EXCHANGE			17138	3451	850	3985	3985	3985	3985	33393	
TOTAL LOCAL CURRENCY			12233	2130	975	2300	2300	2300	2300	22239	
ADJUSTED TOTAL (1/1/88 PRICES)			32332	6111	2045	6845	6845	6845	6845	61082	
PHYSICAL CONTINGENCIES			2263	428	143	481	481	481	481	4276	
TOTAL COST			34595	6538	2189	7345	7345	7345	7345	65357	
ECONOMIC COST			27631	5311	1650	6011	6011	6011	6011	52625	

a/ HERDS/FLOCKS TO BE MONITORED BY THE PROJECT.
b/ GENERAL VETERINARY AND LIVESTOCK HUSBANDRY EQUIPMENT.

c/ IF SUCCESSFUL, THE DECREASED COST OF VEHICLE OPERATIONS WOULD OFFSET THE PURCHASE OF ADDITIONAL RIDING CAMELS.
d/ ONGOING COSTS TO BE FUNDED BY SOMALI GOVERNMENT.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.21 : INVESTMENT COSTS, WATER DEVELOPMENT

W/LIFE	ITEM	FE UNIT (%)	UNIT COST (\$S'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL									
				NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	LOCAL			
CONSTRUCTION																											
	BOREHOLES	EA	1.00	8500	0	1	8500	8500	2	17000	17000	2	17000	17000	2	17000	17000	1	8500	8500	10	85000	85000	0			
	DUGOUTS	EA	0.85	510	0	10	5100	4335	15	7650	6503	15	7650	6503	15	7650	6503	0	0	70	35700	30345	5355				
	WINDMILLS	EA	1.00	83	0	10	830	830	9	747	747	9	747	747	4	332	332	0	0	0	0	32	2656	2656	0		
WELL REHABILITATION																											
	FULL	EA	0.75	85	0	5	425	319	5	425	319	5	425	319	5	425	319	3	255	191	28	2380	1785	595			
	PART	EA	0.75	42	0	5	210	158	5	210	158	5	210	158	5	210	158	3	126	95	28	1176	882	294			
	NEW WELLS	EA	0.75	42	0	5	210	158	5	210	158	5	210	158	5	210	158	3	126	95	28	1176	882	294			
	DUGOUT MAINTENANCE UNITS	EA	8.50	85	0	1	85	43	1	85	43	1	85	43	0	0	0	0	0	0	3	255	128	128			
	PULLEY SYSTEMS (EQUIP & 1 CAMEL)	EA	0.30	128	0	3	384	115	3	384	115	0	0	0	0	0	0	0	0	6	768	230	538				
SUBTOTAL					0		15744	14456		26711	25041		26327	24926		25827	24468		25495	24136		9007	8880		129111	121908	7203
BORE MAINTENANCE UNIT																											
	4 WD (L)	EA	1.00	1245	0	1	1245	1245	0	0	0	0	0	0	1	1245	1245	0	0	2	2490	2490	0				
	MAINTENANCE TOOLS	SET	1.00	209	0	1	209	209	0	0	0	0	0	0	0	0	0	0	0	1	209	209	0				
SUBTOTAL					0		1454	1454	0	0	0	0	0	0	1245	1245	0	0			2699	2699	0				
TOTAL					0		17198	15910		26711	25041		26327	24926		25827	24468		26740	25381		9007	8880		131810	124607	7203
TOTAL FOREIGN EXCHANGE							15910		25041		24926		24468		25381		8880		124607								
TOTAL LOCAL CURRENCY							1288		1670		1401		1359		1359		127		7203								
ADJUSTED TOTAL (1/1/88 PRICES)							17932		27796		27355		26832		27773		9299		136989								
PHYSICAL CONTINGENCIES							1255		1946		1915		1878		1944		651		9589								
TOTAL COST							19188		29742		29270		28711		29717		9950		146578								
ECONOMIC COST							18002		28063		27735		27213		28190		9598		138802								

129

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A7.22 : RECURRENT COSTS, WATER DEVELOPMENT

WDRFE	ITEM	UNIT	FE COST (SS'000)	YEAR PPF		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		TOTAL	
				NO.	COST	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST	FE	NO.	COST
	BORE HOLES EX CROP-I																		
	DIESEL a/	NO.					7												
	HAND	NO.					3												
	HOLES TO BE DRILLED DURING CROP-II	NO.					1			2			2			2			1
	CUMULATIVE NO.	NO.					11			13			15			17			19
	WATER PRODUCTION/ANNUUM																		
	NO. OF SUCCESSFUL BORES WITH ENGINES						8			9			11			14			16
	PRODUCTION @ 20,000 M3 EA ('000 M3) b/						160			180			220			280			320
	NO. OF SUCCESSFUL BORES WITH WINDMILLS						3			4			4			3			3
	PRODUCTION @ 700 M3 EA (M3) c/						2100			2800			2800			2100			2100
	TOTAL PRODUCTION ('000 M3)						162			183			223			282			322
	VEHICLE OPERATION & MAINTENANCE d/ YR	1.00	220	0	1	220	220	1	220	220	1	220	220	1	220	220	1	220	220
	REPAIRS, BORES & PUMPS e/	YR	1.00	VAR	0	1	2750	2750	1	3000	3000	1	3500	3500	1	4000	4000	1	4750
	PUMPING FUEL AND OIL f/	YR	1.00	VAR	0	1	1920	1920	1	2160	2160	1	2440	2440	1	3368	3368	1	3840
	WINDMILL REPAIRS g/	YR	1.00	VAR	0	1	83	83	1	158	158	1	232	232	1	266	266	1	266
	OPERATOR SALARY h/	YR	0.00	VAR	0	1	672	0	1	756	0	1	924	0	1	1176	0	1	1344
	CAMEL FODDER i/	EA/YR	0.00	41.00	0	3	123	0	6	246	0	6	246	0	6	246	0	0	0
	WINDMILL EXPERT (INC. IN CONTRACT PRICE)																		
	TOTAL					0	5768	4973		6540	5538		7762	6592		9268	7846		10420
	TOTAL FOREIGN EXCHANGE							4973			5538			6592			7846		9076
	TOTAL LOCAL CURRENCY							795			1082			1170			1422		1344
	ADJUSTED TOTAL (1/1/88 PRICES)							4076			6907			8194			9788		10961
	PHYSICAL CONTINGENCIES							425			483			574			685		767
	TOTAL COST							4502			7390			8767			10473		11728
	ECONOMIC COST							5925			6687			7942			9476		10732

a/ INCLUDING 2 TO BE COMPLETED BEFORE THE END OF PHASE I.
b/ BASED ON 11 M3/HR, 8 HRS/DAY, 220 DAYS/YEAR.
c/ 3 M3/DAY FOR 220 DAYS.
d/ REFER TABLE A7.7.
e/ INCLUDING PROVISIONS FOR MAJOR OVERHAULS.

f/ 3 L/M3 PUMPED, INCLUDING LUBRICATION. ACTUAL FUEL USE WOULD VARY WITH BORE DEPTH AND PUMP TYPE.
g/ 10% OF INVESTMENT COSTS.
h/ \$57000/MONTH FOR EACH ENGINE DRIVEN PUMP.
i/ FOR CAMELS PURCHASED TO ASSIST WITH DRAWING WATER FROM WELLS.

- 31 -

130
ANNEX 7

b/ PER DIEM: 2.5 NM: 75 DAYS 2 SS4,250/DAY: TOTAL SS318,750.

W/ FARES: AUST. - SOMALIA (1) 2 SS212.500; KENYA - SOMALIA (2)

W/ FARES: AUST.- SOMALIA (1) @ \$5212.500; KENYA - SOMALIA (2) @ \$621.250; ETHIOPIA - SOMALIA (2) @ \$546.750; ZIMBABWI - SOMALIA (1) @ \$542.500; USA - SOMALIA (1) @ \$5255.000; ALL RETURN: TOTAL \$5646.000.

4/ PER DIEMS: 7 PEOPLE FOR 2 WEEKS; 98 DAYS; SS3,400/DAY; TOTAL SS333,800.

9.1

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

MODELS AND PROJECT BENEFITS

MODELS AND PROJECT BENEFITSTABLE OF CONTENTS

	<u>Page</u>
A. PRODUCTION SYSTEM MODELS	1
Central Rangelands Production Systems	1
General Comments	1
Production System Modelling	1
Introduction	1
The Models	1
Model Reliability	2
Management Implications	2
Low Rainfall Pastoral Production Systems	2
Agro-Pastoral Production Systems	2
Other Pastoral Production Systems	3
Major Implied Management Objectives	3
Possible Management Interventions	3
Conclusions	4
B. PROJECT ANALYSIS MODELLING	9
Introduction	9
Prices	9
Financial Prices	9
Economic Prices	10
Models and Supporting Tables	10
Introduction	10
Static Sheep/Goat Model	10
Sheep/Goat Energy Demand	10
Forage Production on Agro-Pastoral Complexes	10
Sheep/Goat Export Parity Price	11
Incremental Forage and Livestock Production	11
Family Unit Crop Model, Agro-Pastoral System	11
Phasing of Agro-Pastoral Complexes	11
Phasing and Benefits from the Deworming Strategy	11
Benefits from Water Development	11
Cumulative Benefits from Cropping on Agro-Pastoral Complexes	12
Cumulative Benefits from Incremental Forage and Livestock	12
Production	12
Summary of Economic Analysis	12
Sensitivity Analysis and Switching Values	12

APPENDIX 1 : Supporting Notes for Production System Sub-Models

LIST OF TABLESTableA. PRODUCTION SYSTEM MODELS

A8.1	: Forage Balance Sub-Model	13
A8.2	: Meat Production Sub-Model	14
A8.3	: Milk Production Sub-Model	15
A8.4	: Human Calory and Protein Balance Sub-Model	17

<u>Table</u>		<u>Page</u>
A8.5	: Income From Livestock	18
A8.6	: Human Calory and Protein Balance and Gross Value of Crop and Livestock Production	20

B. PROJECT ANALYSIS MODELS

A8.7	: Static Sheep/Goat Model	22
A8.8	: Sheep/Goat Energy Demand	23
A8.9	: Forage Production on Agro-Pastoral Complexes	24
A8.10	: Sheep/Goat Export Parity Price	25
A8.11	: Incremental Forage and Livestock Production Per APC	26
A8.12	: Family Unit Crop Model, Agro-Pastoral System	27
A8.13	: Phasing of Agro-Pastoral Complexes	28
A8.14	: Phasing and Benefits from Deworming Strategy	29
A8.15	: Benefits from Water Development	30
A8.16	: Cumulative Benefits from Cropping on Agro-Pastoral Complexes	31
A8.17	: Cumulative Benefits from Forage Development and Livestock Production on APCs	32
A8.18	: Summary of Economic Analysis	33
A8.19	: Sensitivity Analysis and Switching Values	34

LIST OF FIGURES

<u>Figure</u>		
A8.1	: Sub-Models of Production System Components Which Equate Available Forage and Livestock Forage Requirements	5
A8.2	: Sub-Models of Production System Components Indicating Availability of Meat and Milk for Human Consumption	6
A8.3	: Sub-Model of Production System Components Indicating Balance Between Pastoralists and Agro-Pastoralists Nutritional Needs and Supplies From Livestock	7
A8.4	: Sub-Model of Production System Components Indicating Balance Between Pastoralists and Agro-Pastoralists Nutritional Needs and Supplies From All Sources	8

MODELS AND PROJECT BENEFITS

A. PRODUCTION SYSTEM MODELS

CENTRAL RANGELANDS PRODUCTION SYSTEMS^{1/}

General Comments

1. Experience and observations during implementation of CRDP-I indicated that there are seven production systems within Somalia's Central Rangelands. Each system is characterised by a different combination of socio-economic and environmental factors. These result in different production potentials and in existing and future management problems. Consequently, each production system will require different and modified approaches to agricultural development.

PRODUCTION SYSTEM MODELLING

Introduction

2. CRDP-I generated numerous ideas about, and approaches to, rangeland development in Central Somalia. These arise from experience with specific management interventions, and surveys and studies completed during phase I. The project team has developed indicative models for each production system in order to build on, and benefit from, accumulated experience and observations. The objective of the modelling exercise was to develop a system through which it is possible to determine/predict how different components in a production system interact, to indicate the relative complexity of each system, and to provide guidelines for future development. The models are expected to provide insight into constraints and possible management interventions for further development of the Central Rangelands.

The Models

3. The models outlined in this section of the annex are based on information generated by CRDP-I activities and from a wide range of pertinent literature on rangeland development in the semi-arid and arid tropics. Each model of a production system comprises four closely related sub-models, or "families of components". The first sub-model details the balance between forage availability and livestock forage demand during the wet and dry seasons (refer Figure A8.1). The second and third sub-models analyse the extent to which pastoralists and agro-pastoralists are able to derive their nutritional needs from livestock products alone (meat and milk) (refer Figure A8.2), and the fourth sub-model covers the way in which human nutritional needs are met by consideration of all available resources, including agricultural crops and the purchase of food with cash obtained from the sale of livestock, livestock products and crops (refer Figure A8.3). The four sub-models for each production system are linked together into a single, complex, interactive production system (refer Figure A8.4). For the purpose of simplicity, the sub-models have been presented separately in this annex.

4. It should be noted that the production system models developed by project staff are not the basis of project analysis. The models will require considerable refinement as more information is gathered during phase II, particularly from the SIMP studies. The livestock, water development, animal health and agro-pastoral complex models used for project analysis are detailed in Section B of this annex.

^{1/} Adapted from information and models provided by Dr. D. Herlocker, USAID, Rangeland Specialist with CRDP-I.

Model Reliability

5. The production system models developed by CRDP-I's team are considered to be "the first approximations" of the actual situation. They have been based on a very limited amount of reliable, local data which have been interpolated and extrapolated in order to develop a framework for further analysis, e.g. only 23 published references were used to construct the models and over half of these were based on agricultural systems outside the CRDP project area. Furthermore, much of the data were sourced from outside Somalia.

6. Therefore, it should be emphasised that the value of the models lies in the general understanding of the structure of the seven production systems. The models also indicate how the systems' components interact and demonstrate the complexity of pastoralism and agro-pastoralism in Central Somalia. In addition, they provide an initial insight into possible management interventions which may not have been considered in the past, and reflect possible implications of existing or suggested development activities.

7. Finally, the production system models provide a principal data-base framework. As additional information on the systems is collated and collected, additions and alterations can be made, thereby leading to a clearer understanding of how the systems work.

MANAGEMENT IMPLICATIONS

8. The models of the seven different production systems indicate that the systems can be categorised into groups with similar problems and indications of similar types of management interventions.

Low Rainfall Pastoral Production Systems

9. The main characteristic of the Interior Dwarf Shrub/Grassland (IDS/G) and the Northern Plateau (NP) production systems is the seasonal imbalance between livestock demand for forage and low forage production, and seasonally high to very high livestock biomasses. The models indicate that very little forage remains unutilised in the IDS/G system by the end of the wet season and that there is a deficiency of forage in the NP system by the end of the wet season. Over the long-term, this imbalance could lead to serious degradation and lower productivity. Therefore, the principal objective of management should be to remedy the livestock/forage imbalance by reducing the pressure on forage. Strategic development of additional water points may be one option.

Agro-Pastoral Production Systems

10. The Agro-Pastoral Sands (APS) and Agro-Pastoral Clay (APC) production systems are characterised by relatively high levels of residual forage (560 kg/ha at the end of the wet season). This is probably due to high human populations but only moderate numbers of livestock. This results in negative human calorie balances in both agro-pastoral systems in the wet and dry seasons (Table A8.4). The APS system only has a positive human protein balance in the wet season. These protein and calorie deficits are overcome by cropping (Table A8.6), or through the purchase of food with proceeds from livestock sales (Table A8.5).

11. The principal objective of development should be to increase per capita income so that agro-pastoral families are able to reduce the effect of drought. This could be achieved by increased use of under-utilised forage, which would result in more saleable livestock, and increased productivity from agricultural cropping. Long-term reliability of both livestock and crop outputs could be assisted by conservation practices.

Other Pastoral Production Systems

12. The other production systems cannot be grouped together. Future management and development interventions should focus on reducing the human protein and energy deficiencies which occur in all systems in either the wet or dry seasons, or both (Table A8.4). The Coastal Plain system has negative energy and protein balances (from livestock) in both seasons, while the Western Shebelle system only suffers from an energy deficiency in the dry season. The IDS/G system is characterised by large fluctuations in the availability of energy and protein (Table A8.4). The NP system is the same; surplus energy and protein in the wet season and deficiencies of both in the dry season.

Major Implied Management Objectives

13. Production system modelling has identified six major management objectives which should be met and optimised in the long-run in order to overcome existing imbalances between production, utilisation and nutritional requirements. These are as follows:-

- (a) Remedy the imbalance between livestock and forage.
- (b) Increase per capita income of both pastoralists and agro-pastoralists.
- (c) Increase the productivity of agricultural crops within agro-pastoral areas.
- (d) Carry out conservation practices to assist with environmental and production stability.
- (e) Remedy nutritional (milk and meat-based) deficits.
- (f) Make better use of surplus livestock, particularly young goats and sheep.

Possible Management Interventions

14. There are a number of interventions which might be used to meet management's major objectives. These are listed below under the heading of each major objective.

Remedy the Imbalance Between Forage and Livestock

- (a) Increase availability of water in presently unwatered areas by drilling new boreholes.
- (b) Provide better distribution of grazing within areas for which there are already boreholes, through the provision of dugouts, shallow hand-dug wells, etc.
- (c) Reduce watering frequency of livestock in order to reduce dry matter intake levels.
- (d) Increase efficiency of forage use by livestock by deworming and other simple veterinary measures.
- (e) Upgrade poor range condition areas to increase both forage and livestock productivity.
- (f) Utilise selected high watertable sites to produce more forage, especially dry season forage.
- (g) Increase forage production, especially within agro-pastoral areas, by introducing higher yielding and multi-purpose forage species.

Increase Per Capita Income

- (a) Increase forage use efficiency by treatment of livestock for worms, and by other simple veterinary measures.

- (b) Improve growth rates of livestock through preferential feeding of young stock.
- (c) Other applicable improved animal husbandry measures.
- (d) Increase marketing of surplus animals by providing better access to markets (roads, ports, etc.).
- (e) Improve rural credit services.
- (f) Investigate alternative means of earning a living (fishing, gypsum mining, meershum carving, charcoal production, bee-keeping, etc.).

Implement Conservation Practices to Assist With Environmental and Production Stability

- (a) Erosion control measures, such as strip cropping on farms.
- (b) Rehabilitation of degraded areas around villages (sand dune stabilisation, shelterbelts, village reserves, individual household tree plantings, etc.).
- (c) Improve the range condition of degraded rangelands (controlled grazing schemes).
- (d) Live fencing of farms to reduce the amount of trees cut to build thorn fences.
- (e) Tree nurseries to produce seedlings for village and farm plantings.

Remedy Nutritional Deficits (Milk and Meat-Based) of Human Populations and Make Better Use of Surplus Livestock

Refer to above-listed strategies which focus on livestock.

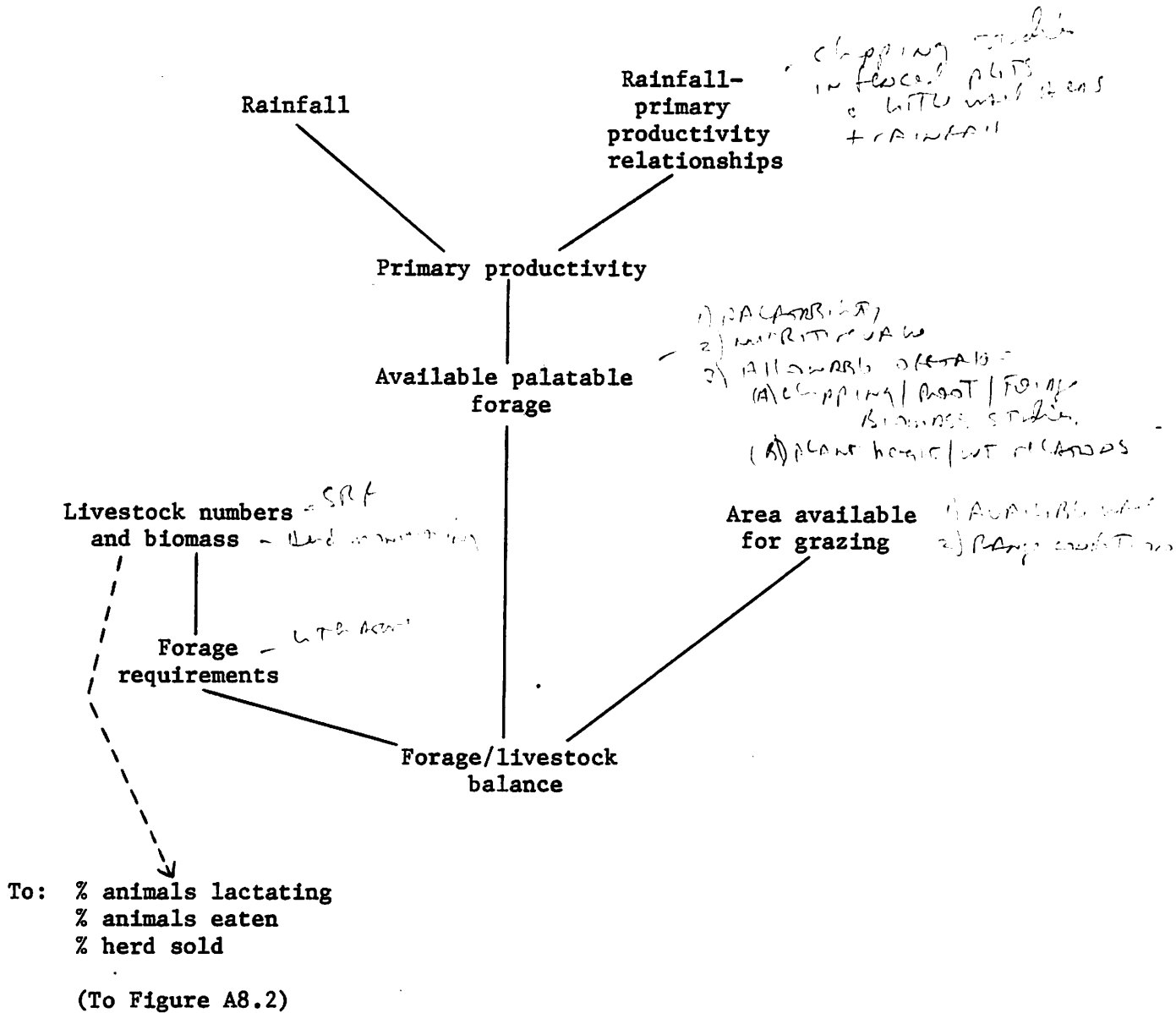
Conclusions

15. In some cases the type of management interventions required to meet a specific objective appear to be fairly clear. For example, water development in the NP production system, a large proportion of which is unwatered and which has a large annual imbalance between livestock and available forage. The placement of additional boreholes within the unwatered part of this production system would help distribute grazing over a larger area and make more forage available to existing livestock.

16. Most of the possible management interventions listed above, however, could be applicable over a range of production systems and to more than one major management objective. Whether in fact a particular management intervention is applicable, as well as its scope, location, phasing, etc., remains to be determined by surveys and studies of the production systems.

138

FIGURE A8.1 : SUB-MODELS OF PRODUCTION SYSTEM COMPONENTS WHICH EQUATE AVAILABLE FORAGE AND LIVESTOCK FORAGE REQUIREMENTS

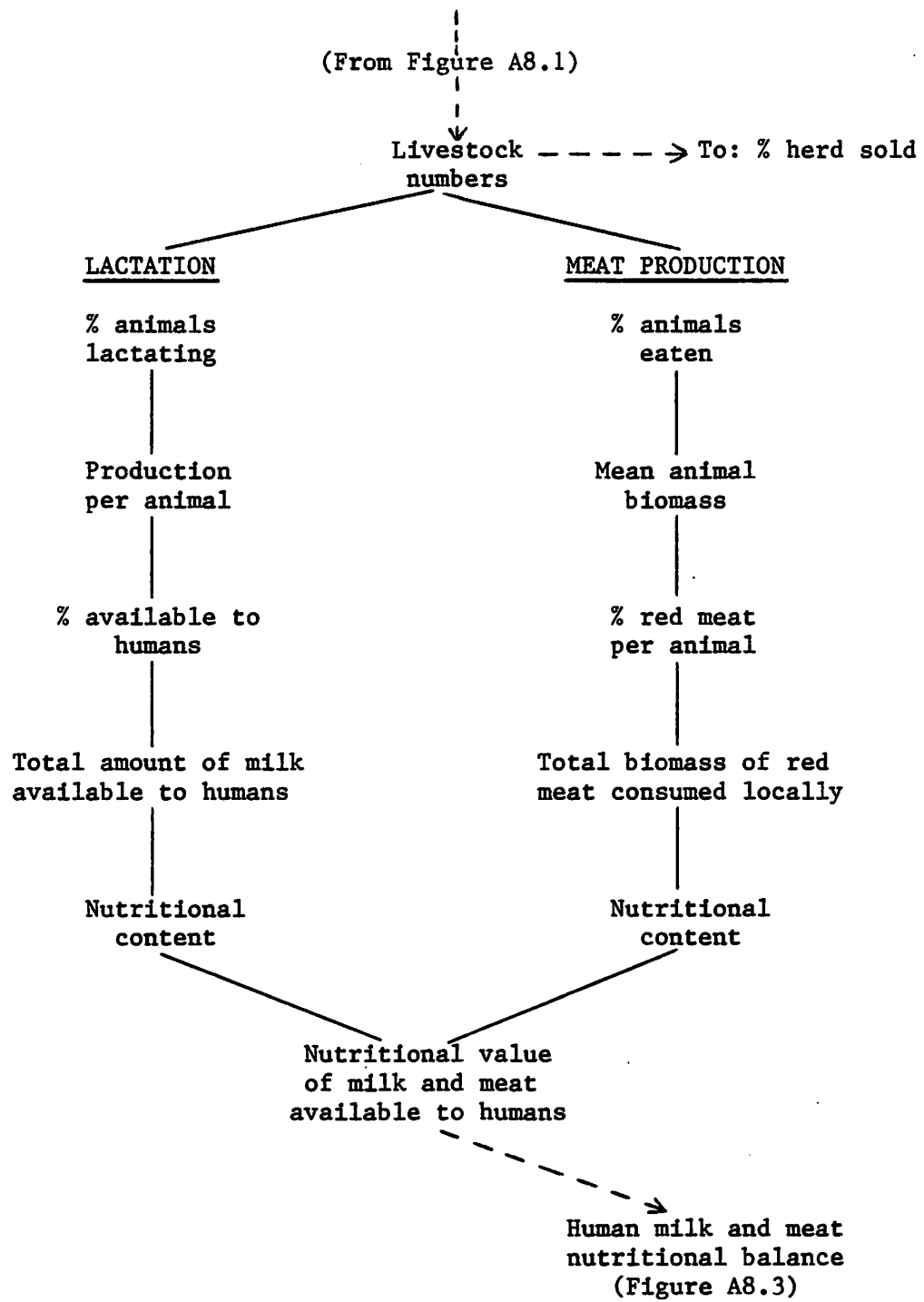


_____ Within sub-model relationships.

----- Relationship with one of the other sub-models.

Note: Refer Table A8.1 for details.

FIGURE A8.2 : SUB-MODELS OF PRODUCTION SYSTEM COMPONENTS INDICATING AVAILABILITY OF MEAT AND MILK FOR HUMAN CONSUMPTION



Note: Refer Tables A8.2 (Meat Production) and A8.3 (Milk Production) for details.

FIGURE A8.3 : SUB-MODEL OF PRODUCTION SYSTEM COMPONENTS INDICATING BALANCE
BETWEEN PASTORALISTS AND AGRO-PASTORALISTS NUTRITIONAL NEEDS AND SUPPLIES
FROM LIVESTOCK

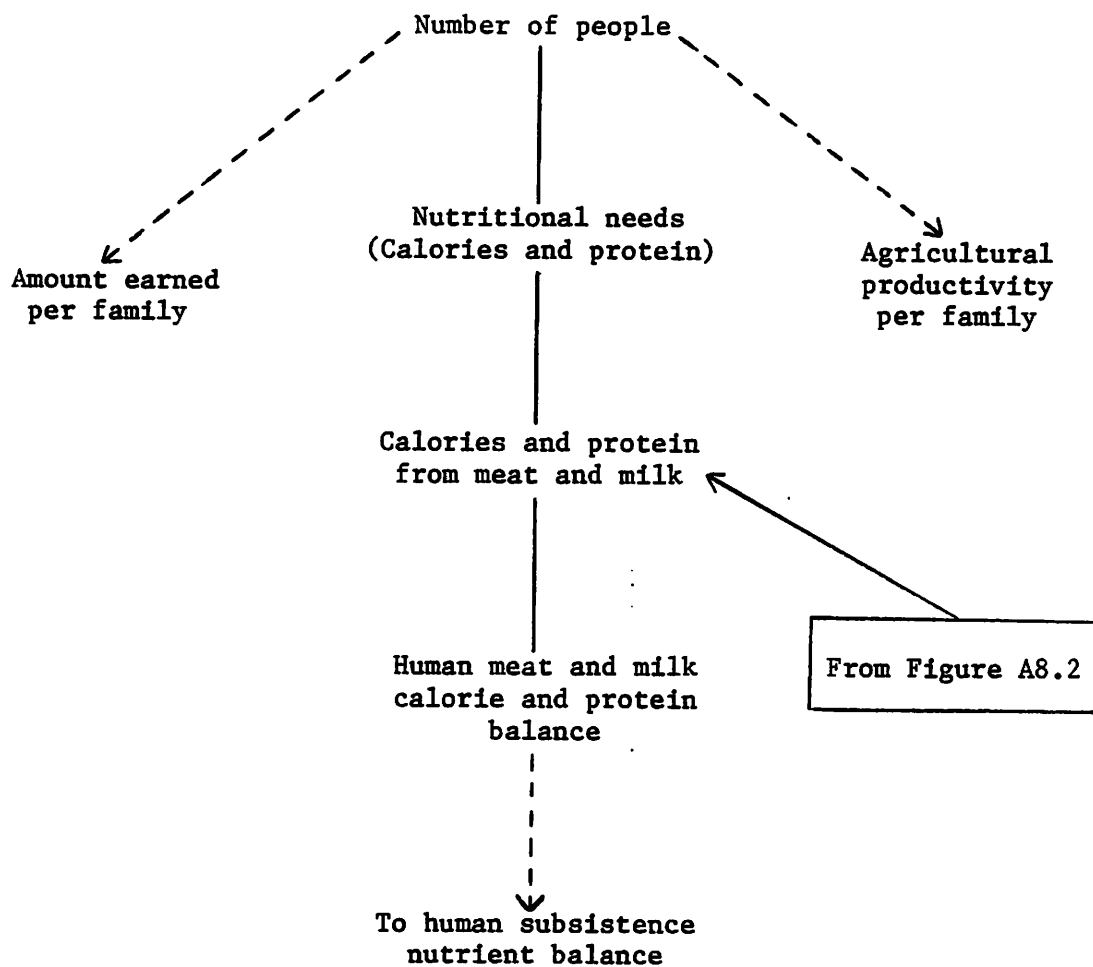
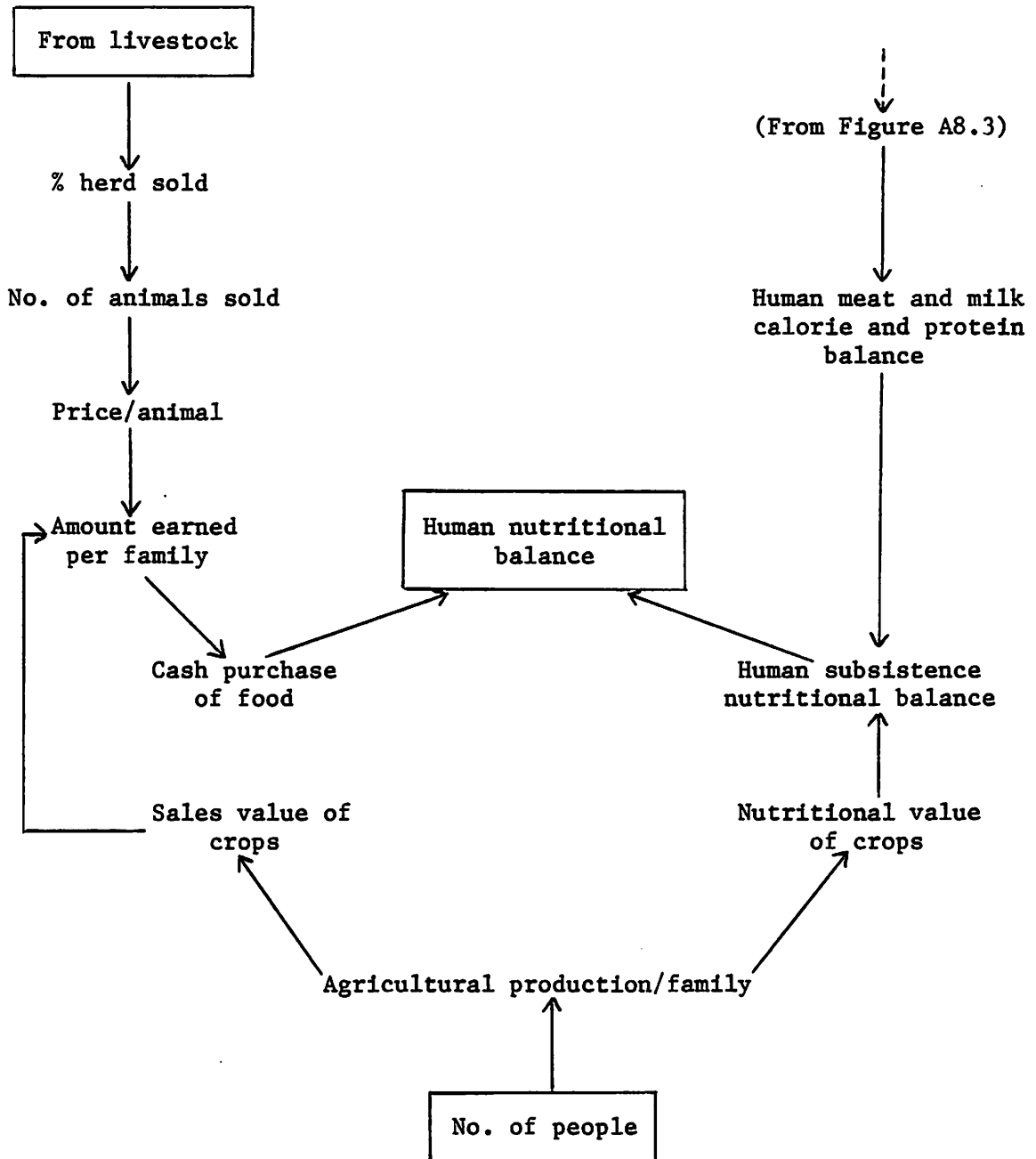


FIGURE A8.4 : SUB-MODEL OF PRODUCTION SYSTEM COMPONENTS INDICATING BALANCE
BETWEEN PASTORALISTS AND AGRO-PASTORALISTS' NUTRITIONAL NEEDS AND SUPPLIES
FROM ALL SOURCES



B. PROJECT ANALYSIS MODELLING

INTRODUCTION

17. This section of the annex summarises the models developed for project analysis and the methodology used for analysis. A standard approach was used, i.e. the costs were converted from financial to economic values by multiplying local currency costs by the Standard Conversion Factor (SCF) ^{1/} and foreign exchange costs were net of duties, taxes, etc. Similarly, benefits were converted from financial to economic values by multiplying the value of non-traded goods (non-exported livestock, milk, cowpea and mungbean) by the SCF and by using the export parity price for exported goods (exported sheep/goats).

18. The analysis was based on a sheep and goat livestock production model. This is because the deworming strategy would be focused on male sheep and goats destined for export, and incremental forage production following establishment of buffel grass on APCs would also be allocated to this class of livestock. The other incremental livestock production model (water development) was analysed using the standard sheep/goat model because it was not possible to determine which category of livestock (sheep, goats, camels and cattle) would actually consume the incremental forage made available by the development of additional water points. Furthermore, project analysis is simplified if one standard livestock model is used to determine the effect of development interventions on family incomes and the economic rate of return. Finally, sheep and goats are the main category of livestock in the project area (on a numerical basis) and therefore it is logical to base analysis on a sheep/goat model.

PRICES

Financial Prices

19. Prices of non-traded goods were collected by project (CRDP-I) staff from markets and published price information and then converted to farm-gate prices by allowing for transport costs. In addition, price information collated by the Mascott team was also used. The financial prices used for analysis are as follows:-

(a) Meat (sheep/goat)

Cull females	SoSh 1,800/head
Males : 0-1 yrs	" 1,200/head
1-2 yrs	" 2,200/head
2-3 yrs	" 3,530/head*
3-4 yrs	" 3,530/head*

* Based on 30% export @ SoSh 3,600/head and 70% local sales @ SoSh 3,500/head (approximately SoSh 120/kg).

(b) Milk (goat)

Wet season	SoSh 12/1 (30%)
Dry season	" 25/1 (70%)
Weighted average	" 21/1

^{1/} SCF = 0.71 (SoSh 85/SoSh 120).

Economic Prices

(a) <u>Meat</u> (sheep/goat)		
Cull females	SoSh	1,270/head ^{1/}
Males : 0-1 yrs	"	850/head ^{1/}
1-2 yrs	"	1,560/head ^{1/}
2-3 yrs	"	2,920/head*
3-4 yrs	"	2,920/head*

* Based on 30% export @ SoSh 3,880/head (export parity price - refer Table A8.10) and 70% local sales @ SoSh 3,530/head x SCF (0.71) = SoSh 2,918/head.

(b) Milk (goat)
SoSh 21/1 (financial price) x SCF (0.71) = SoSh 15/1.

MODELS AND SUPPORTING TABLES

Introduction

20. Project analysis was based on four productive interventions; strategic deworming of male sheep and goats destined for export; forage development on agro-pastoral complexes; changed cropping practices on APCs; and strategic development of additional water points in areas with under-utilised forage resources. This section of the annex outlines the models developed for project analysis and explains how they are linked together on a step-by-step basis.

Static Sheep/Goat Model (Table A8.7)

21. This model shows natural increase, deaths and sales for a static herd/flock of 1,000 sheep/goats. The production parameters used in the model were collated from publications by GTZ's veterinary team and adjusted to reflect the production from a static herd/flock with age and sex class structures which reflect the strategies of maximising the percentage of females in the herds/flocks, and milk production. The turn-off from the static model is 24.2%, higher than reported in some technical literature. However, this figure includes the sale of very young males (0-1 year age class), whereas it is probable that pastoralists and agro-pastoralists report these as deaths, and not sales.

22. This model has been used as the basis for analysis of the three interventions which focus on livestock production; forage production on APCs, strategic deworming and water development.

Sheep/Goat Energy Demand (Table A8.8)

23. This model predicts the energy demand by a 1,000 head static herd/flock of sheep/goats. The energy demand (in '000 MJ) was equated against incremental forage supplies from increased areas of buffel grass (Tables A8.9 and A8.11) to determine how many additional sheep/goats an APC could carry if buffel grass was planted on the fallow blocks.

Forage Production on Agro-Pastoral Complexes (Table A8.9)

24. This model shows the average incremental forage production from five agro-pastoral complexes, each in a different phase of a cropping cycle. The model assumes that APCs are cropped on a five-year cycle and that a 20-year

^{1/} Financial price x SCF of 0.71 (SoSh 85/SoSh 120).

144

cycle is sustainable. Incremental forage is converted to incremental energy in Table A8.11.

Sheep/Goat Export Parity Price (Table A8.10)

25. Not a model; a table which shows the calculation of the export parity price for sheep/goats, refer Section on prices.

Incremental Forage and Livestock Production (Table A8.11)

26. This model equates incremental forage production with incremental livestock, on a metabolisable energy basis using the forage production model (Table A8.9), the energy demand model (Table A8.8), and the static herd/flock model (Table A8.7). The model predicts incremental sales and incremental milk production for a family unit on an APC.

Family Unit Crop Model, Agro-Pastoral System (Table A8.12)

27. This model shows the with and without-project areas of crop, types of crop, crop yields and incremental incomes for an APC which accepts the promotion of improved varieties of cowpea and the introduction of mungbean as an alternate legume crop. It has been assumed that sorghum yields would remain static (with and without-project) and that the yields of cowpea and mungbean would increase from 530 to 800 kg/ha, and from 260 to 325 kg/ha respectively (in the Gu season).

Phasing of Agro-Pastoral Complexes (Table A8.13)

28. This table shows how the agro-pastoral complexes would phase into the project, based on the assumption that each VEW in the agro-pastoral systems would work with 80 contact families for two years before selecting a new group to assist. Acceptance rates have been set at 50% (years 1-2), 60% (years 3-4), 70% (years 5-6), and 80% thereafter.

Phasing and Benefits from the Deworming Strategy (Table A8.14)

29. This model scales up the benefits from strategic deworming. It is based on the number of Nomadic Animal Health Assistants (NAHAs) working in the Coastal Plain, Agro-Pastoral Clay and Agro-Pastoral Sand production systems, and a conservative ongoing acceptance rate of 50%. This allows for the development of resistance to the drenches used. The incremental sales per family have been determined from the reported wet season numbers of sheep and goats (on a family basis) in the above-listed production systems (refer Table A8.2). It has been assumed that only the older age classes of male sheep and goats would be dewormed. Incremental meat production per head is estimated to average 4 kg (GTZ report gains of up to 6 kg/head).

Benefits from Water Development (Table A8.15)

30. Incremental benefits from water development were calculated on the basis of incremental supplies of water and incremental supplies of forage. The incremental benefits from the availability of extra forage (after the development of water points) were used for project analysis. Calculations were based on the additional turn-off and milk production from the incremental sheep/goats which could be carried following the development of extra permanent and semi-permanent water points. The static herd/flock model (Table A8.7) was used to determine the incremental benefits. The value of incremental milk production (from goats) was calculated from the model of incremental forage and livestock production per APC (Table A8.11). The ratio of the benefits from milk to the benefits from meat (in Table A8.11) is approximately 70%.

Cumulative Benefits from Cropping on Agro-Pastoral Complexes (Table A8.16)

31. This table scales up the gross economic benefits from cropping on agro-pastoral complexes. It is based on the number of families accepting the crop-based intervention (Table A8.13) and the benefits per family (converted from financial to economic prices), (Table A8.12).

Cumulative Benefits from Incremental Forage and Livestock Production (Table A8.17)

32. This table scales up the gross economic benefits from forage development on APCs and subsequent increased livestock production. It is based on the number of families accepting the crop and forage-based interventions (Table A8.13) and the benefits per family (converted from financial to economic prices) (Table A8.11).

Summary of Economic Analysis (Table A8.18)

33. This table summarises the economic benefits from the four quantified development interventions, and the project period (years 1-6) and the ongoing economic costs after the disbursement period. Quantified benefits for agro-pastoral livestock production, agro-pastoral cropping, water development and strategic deworming are listed for the 20-year project life, and the economic costs for each component/activity are also given for a 20-year period. The net economic benefit stream over 20 years has an economic rate of return of 8.9%.

Sensitivity Analysis and Switching Values (Table A8.19)

34. This table shows the changes in the economic rate of return if costs decrease/increase and benefits decrease/increase. Switching values have also been calculated.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.1 : FORAGE BALANCE SUB-MODEL

FLSBLC															
ITEM a/	CALC.	COASTAL PLAIN		AGROPASTORAL SANDS		AGROPASTORAL CLAYS		WESTERN SHEBELLE		INTERIOR SHRUBLAND		INT.DF.SHRUB/GRASSLAND		NORTHERN PLATEAU	
1 RAINFALL (MM/YR.)		250		300		280		280		250		150		150	
2 RAINFALL:PRODUCTION FACTOR		7.20		7.33		7.50		7.50		7.20		6.67		6.67	
3 PRIMARY PRODUCTION (KG/HA/YR)	1 X 2	1800		2200		2100		2100		1800		1000		1000	
4 PRODUCTION:AVAILABILITY FACTOR		40.00		34.55		34.48		34.48		34.39		35.20		34.40	
5 AVAILABLE FORAGE (KG/KM2/YR.)	3 X 4	72000		76000		72400		72400		61900		35200		34400	
LIVESTOCK BIOMASS (KG/KM2)		WET SEASON		WET SEASON		WET SEASON		WET SEASON		WET SEASON		WET SEASON		WET SEASON	
6 CATTLE		795	301	814	367	148	1685	1346	1160	25	261	1613	59	2029	0
7 SHEEP		424	230	385	395	546	369	123	96	174	155	378	144	325	14
8 GOATS		688	558	898	1588	869	801	281	280	1166	775	1196	517	2029	89
9 CAMELS		195	103	2213	800	1383	1207	4475	2277	1848	1882	5046	374	20417	717
10 TOTAL		2102	1192	4310	3150	2946	4062	6225	3813	3213	2273	8233	1094	24800	820
11 FORAGE NEED FACTOR (% BODY, DM)		3	5	3	5	3	5	3	5	3	5	3	5	3	5
12 FORAGE NEEDS (KG/KM2/DAY)	10 X 11	63	60	129	158	88	203	187	191	96	114	247	55	744	41
13 DURATION OF WET SEASON (DAYS)		130	235	150	215	188	185	180	185	120	245	120	245	120	120
14 SEASONAL FORAGE NEEDS (KG/KM2)	12 X 13	8198	14006	19395	33863	15908	37574	33615	35278	11567	27844	29439	13402	89288	4920
15 TOTAL AREA (KM2)		15535	13115	18605	15250	7930	7625	5185	4575	21655	19215	60695	47275	9150	1525
16 TOTAL FORAGE NEEDS ('000 T)	14 X 15	127517	183689	360844	516403	126154	286498	174294	161361	258479	535027	1798927	633556	816912	7503
17 TOTAL FORAGE AVAILABLE ('000 T)	15 X 5	1119960	944280	1413979	1158999	574132	552058	375394	331230	1340444	1189408	2136462	1664078	314760	52460
18 FORAGE REMAINING : ('000 T)	17 - 16	992443	760591	1053135	642596	447978	265552	201108	169869	1089965	654381	337535	1030522	-502152	44957
19 FORAGE REMAINING : KG/KM2	18/15	63802	57994	56605	42137	56492	34826	38785	37130	50333	34056	5561	21798	-54880	29480
20 FORAGE REMAINING : KG/HA	19/100	638	580	566	421	565	348	388	371	503	341	56	218	-549	295

a/ REFER APPENDIX I FOR DETAILS ON THE SOURCE OF INFORMATION AND/OR CALCULATION FOR EACH ITEM.
NOTE : MINOR ERRORS DUE TO ROUNDING.

146

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.2 : MEAT PRODUCTION SUB-MODEL

ITEM NO./ MEATP CALC.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1 X 4 2 X 5					6 X 8 7 X 8					9 X 11		10 X 11		12X14 13X14		12X17 13X17		
	ANIMALS/KM2		PERCENT HERD EATEN		NO. STOCK EATEN (AN/KM2)		BIO MASS (KG/AN)	BIO MASS KILLED (KG/KM2)		MEAT %	MEAT EATEN (KG/KM2)		CAL. PER KG	CAL./KM2		PROTEIN (GV/KG)	PROTEIN (GV/KM2)		
CP	WET	DRY	TOTAL	WET	DRY	WET	DRY		WET	DRY		WET	DRY		WET	DRY		WET	DRY
CATTLE	4.4	1.7	4	1	3	0.044	0.051	180	7.92	9.18	50	3.96	4.59	2400	9504	11016	150	594	689
SHEEP	26.5	14.4	5	2	3	0.530	0.432	16	8.48	6.91	50	4.24	3.46	2400	10176	8294	150	636	518
GOATS	43.0	34.9	12	4	8	1.720	2.792	16	27.52	44.67	50	13.76	22.34	2400	33024	53606	150	2064	3350
CAMELS	0.6	0.3	2	0	2	0.000	0.006	300	0.00	1.80	50	0	0.90	2400	0	2160	150	0	135
TOTAL	74.5	51.3				2.294	3.281		43.92	62.56		21.96	31.28		52704	75077		3294	4692
APS																			
CATTLE	4.5	2.0	4	1	3	0.045	0.060	180	8.10	10.80	50	4.05	5.40	2400	9720	12960	150	608	810
SHEEP	24.1	24.7	5	2	3	0.482	0.741	16	7.71	11.86	50	3.856	5.93	2400	9254	14227	150	578	889
GOATS	56.1	99.3	12	4	8	2.244	7.944	16	35.90	127.10	50	17.952	63.55	2400	43085	152525	150	2693	9533
CAMELS	7.3	2.6	2	0	2	0.000	0.052	300	0.00	15.60	50	0	7.80	2400	0	18720	150	0	1170
TOTAL	92	128.6				2.771	8.797		51.72	165.36		25.86	82.68		62059	198432		3879	12402
APC																			
CATTLE	0.8	9.4	4	1	3	0.008	0.282	180	1.44	50.76	50	0.72	25.38	2400	1728	60912	150	108	3807
SHEEP	34.1	23.1	5	2	3	0.482	0.693	16	10.91	11.09	50	5.456	5.54	2400	13094	13306	150	818	932
GOATS	54.3	50.1	12	4	8	2.172	4.008	16	34.75	64.13	50	17.376	32.06	2400	41702	76954	150	2606	4810
CAMELS	4.5	4.0	2	0	2	0.000	0.080	300	0.00	24.00	50	0	12.00	2400	0	28800	150	0	1800
TOTAL	93.7	86.6				2.862	5.063		47.10	149.98		23.55	74.99		56525	179971		3533	11248
US																			
CATTLE	7.5	6.4	4	1	3	0.075	0.192	180	13.50	34.56	50	6.75	17.28	2400	16200	41472	150	1013	2592
SHEEP	7.7	6.0	5	2	3	0.154	0.180	16	2.46	2.88	50	1.232	1.44	2400	2957	3456	150	185	216
GOATS	17.7	17.5	12	4	8	0.708	1.400	16	11.33	22.40	50	5.664	11.20	2400	13594	26880	150	950	1680
CAMELS	14.7	7.5	2	0	2	0.000	0.150	300	0.00	45.00	50	0	22.50	2400	0	54000	150	0	3375
TOTAL	47.6	37.4				0.937	1.922		27.29	104.84		13.65	52.42		32750	125808		2047	7863
IS																			
CATTLE	0.1	1.4	4	1	3	0.001	0.042	180	0.18	7.56	50	0.09	3.78	2400	216	9072	150	14	567
SHEEP	10.9	9.7	5	2	3	0.218	0.291	16	3.49	4.66	50	1.744	2.33	2400	4186	5587	150	262	349
GOATS	72.9	48.5	12	4	8	2.916	3.889	16	46.66	62.08	50	23.328	31.04	2400	55987	74496	150	3499	4656
CAMELS	6.1	3.6	2	0	2	0.000	0.072	300	0.00	21.60	50	0	10.80	2400	0	25920	150	0	1620
TOTAL	90.0	63.2				3.135	4.285		50.32	95.90		25.16	47.95		60389	115075		3774	7192
IOS/6																			
CATTLE	9.0	0.3	4	1	3	0.090	0.009	180	16.20	1.62	50	8.1	0.81	2400	19440	1944	150	1215	122
SHEEP	23.6	9.0	5	2	3	0.472	0.270	16	7.55	4.32	50	3.776	2.16	2400	9062	5184	150	566	324
GOATS	74.7	32.3	12	4	8	2.988	2.584	16	47.81	41.34	50	23.904	20.67	2400	57370	49613	150	3586	3101
CAMELS	16.7	1.2	2	0	2	0.000	0.024	300	0.00	7.20	50	0	3.60	2400	0	8640	150	0	540
TOTAL	124.0	42.8				3.55	2.887		71.56	54.48		35.78	27.24		85872	65381		5367	4086
NP																			
CATTLE	11.3	0.0	4	1	3	0.113	0.000	180	20.34	0.00	50	10.17	0.00	2400	24408	0	150	1526	0
SHEEP	20.3	0.9	5	2	3	0.406	0.027	16	6.50	0.43	50	3.248	0.21	2400	7795	513	150	487	32
GOATS	126.8	5.5	12	4	8	5.072	0.440	16	81.15	7.04	50	40.576	3.52	2400	97382	8448	150	6086	528
CAMELS	67.2	2.4	2	0	2	0.000	0.048	300	0.00	14.40	50	0	7.20	2400	0	17280	150	0	1088
TOTAL	225.6	8.79				5.591	0.5147		107.99	21.87		53.99	10.93		129586	26241		8099	1640

a/ REFER APPENDIX 1 FOR DETAILS ON THE SOURCE OF INFORMATION AND/OR CALCULATION FOR EACH ITEM.

NOTE : MINOR ERRORS DUE TO ROUNDING.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.3 : MILK PRODUCTION SUB-MODEL

ITEM NO.a/ MLKP CALC.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
				1 X 3	2 X 3				7 X 4	8 X 5		9 X 11	10 X 11		9 X 14	10 X 14
	ANIMALS/KM2		% HERD LACTATING	NUMBER LACTATING		MILK AVAIL FOR HUMANS			MILK AVAIL. FOR HUMANS (LIT/KM2)		CAL. PER LITRE	CALORIES PER KM2		PROTEIN (GM/LIT)	PROTEIN (GM/KM2)	
CP	WET	DRY		WET	DRY	WET	DRY		WET	DRY		WET	DRY		WET	DRY
CATTLE	4.4	1.7	35	1.54	0.60	218	153	65	236	39	700	164934	27073	35	8247	1354
SHEEP	26.5	14.4	0	0.00	0.00	0	0	0	0	0	700	0	0	35	0	0
GOATS	43.0	34.9	19	8.17	6.63	44	31	13	253	86	700	177289	60342	35	8864	3017
CAMELS	0.6	0.3	25	0.15	0.08	955	668	287	100	22	700	70140	15068	35	3507	753
TOTAL	74.5	51.3							589	146		412363	102482		20618	5124
APS																
CATTLE	4.5	2	35	1.58	0.70	218	153	65	241	46	700	168682.5	31850	35	8434	1593
SHEEP	0	0	0	0.00	0.00	0	0	0	0	0	700	0	0	35	0	0
GOATS	56.1	99.3	19	10.66	18.87	44	31	13	330	245	700	231300.3	171690	35	11565	8584
CAMELS	7.3	2.6	25	1.83	0.65	955	668	287	1219	187	700	853370	130585	35	42669	6529
TOTAL	67.9	103.9							1791	477		1253353	334125		62668	16706
APC																
CATTLE	0.8	9.4	35	0.28	3.29	218	153	65	43	214	700	29988	149695	35	1499	7485
SHEEP	0	0	0	0.00	0.00	0	0	0	0	0	700	0	0	35	0	0
GOATS	54.3	50.1	19	10.32	9.52	44	31	13	320	124	700	223879	86623	35	11194	4331
CAMELS	4.5	4	25	1.13	1.00	955	668	287	752	287	700	526050	200900	35	26303	10045
TOTAL	59.6	63.5							1114	625		779917	437218		38996	21861
WS																
CATTLE	7.5	6.4	35	2.63	2.24	218	153	65	402	146	700	281138	101920	35	14057	5096
SHEEP	0	0	0	0.00	0.00	0	0	0	0	0	700	0	0	35	0	0
GOATS	17.7	17.5	19	3.36	3.33	44	31	13	104	43	700	72977	30258	35	3649	1513
CAMELS	14.7	7.5	25	3.68	1.88	955	668	287	2455	538	700	1718430	376688	35	85922	18834
TOTAL	39.9	31.4							2961	727		2072545	508865		103627	25443

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.3 : MILK PRODUCTION SUB-MODEL

ITEM NO.a/	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16				
NLKP CALC.			1 X 3		2 X 3				7 X 4		8 X 5		9 X 11		10 X 11		9 X 14		10 X 14	
IS																				
CATTLE	0.1	1.4	35	0.04	0.49	218	153	65	5	32	700	3748.5	22295	35	187	1115				
SHEEP	0.0	0.0	0	0.00	0.00	0	0	0	0	0	700	0	0	35	0	0				
GOATS	72.9	48.5	19	13.85	9.22	44	31	13	429	120	700	300567	83857	35	15028	4193				
CAMELS	6.1	3.6	25	1.53	0.90	955	668	287	1019	258	700	713090	180810	35	35655	9041				
TOTAL	79.1	53.5							1453	410		1017405	286962		50870	14348				
IDS/6																				
CATTLE	9.0	0.3	35	3.15	0.11	218	153	65	482	7	700	337365	4778	35	16868	239				
SHEEP	0.0	0.0	0	0.00	0.00	0	0	0	0	0	700	0	0	35	0	0				
GOATS	74.7	32.3	19	14.19	6.14	44	31	13	440	80	700	307988	55847	35	15399	2792				
CAMELS	16.7	1.2	25	4.18	0.30	955	668	287	2789	86	700	1952230	60270	35	97612	3014				
TOTAL	100.4	33.8							3711	173		2597583	120894		129879	6045				
NP																				
CATTLE	11.3	0.0	35	3.96	0.00	218	153	65	605	0	700	423581	0	35	21179	0				
SHEEP	0.0	0.0	0	0.00	0.00	0	0	0	0	0	700	0	0	35	0	0				
GOATS	126.8	5.5	19	24.09	1.05	44	31	13	747	14	700	522796	9510	35	26140	475				
CAMELS	67.2	2.4	25	16.80	0.60	955	668	287	11222	172	700	7855680	120540	35	392784	6027				
TOTAL	205.3	7.9							12574	186		8802057	130050		440103	6502				

a/ REFER APPENDIX 1 FOR DETAILS ON THE SOURCE OF INFORMATION AND/OR CALCULATIONS FOR EACH ITEM.
NOTE : MINOR ERRORS DUE TO ROUNDING.

149

150

SONALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.4 : HUMAN CALORY AND PROTEIN BALANCE SUB-MODEL

ITEM NO. a/	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
HUMBLIC CALC.				1X3	2X3			6X7	4+8	5+8		9X11	10X11		9X14	10X14
	NOMAD HOUSES PER KM2		NOMAD PEOPLE PER HOUSE	NOMAD PEOPLE PER KM2		PERM. HOUSE PER KM2	PEOPLE PER HOUSE	PERM. PEOPLE PER KM2	TOTAL PEOPLE PER KM2		CAL. PER PERSON PER DAY	CALORIES PER KM2 PER DAY		PROTEIN (GV/PER. /DAY)	PROTEIN (GV/KM2/DAY)	
PRODUCTION SYSTEM	WET	DRY		WET	DRY				WET	DRY		WET	DRY		WET	DRY
CP	1.20	0.30	4.50	5.40	2.25	0.00	5.32	0.00	5.40	2.25	2024	10930	4554	36	194	81
APS	0.65	0.40	4.50	2.93	1.80	0.65	5.32	3.46	6.38	5.26	2024	12919	10642	36	230	189
APC	2.70	1.00	4.50	12.15	4.50	0.73	5.32	3.88	16.03	8.38	2024	32452	16968	36	577	302
WS	0.90	0.30	4.50	4.05	1.35	0.19	5.32	1.81	5.06	2.36	2024	10243	4778	36	182	85
IS	0.60	0.70	4.50	2.70	3.15	0.32	5.32	1.70	4.40	4.85	2024	8910	9821	36	158	175
IDS/G	0.50	0.50	4.50	2.25	2.25	0.10	5.32	0.33	2.78	2.78	2024	5631	5631	36	100	100
UK	0.70	0.40	4.50	3.15	1.80	0.00	5.32	0.00	3.15	1.80	2024	6376	3643	36	113	65

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
12X17		13X18	15X17	16X18	(FROM TABLES A8.2 & A8.3)					(FROM TABLES A8.2 & A8.3)							
SEASON CALORY NEEDS (('000 CAL/KM2)		SEASON PROTEIN NEEDS (('000 GV/KM2)		TOTAL CALORY SUPPLY (('000 CAL/KM2)				TOTAL PROTEIN SUPPLY (('000 GV/KM2)				CALORY BALANCE (('000 CAL/KM2)		PROTEIN BALANCE (('000 GV/KM2)			
DAYS/SEASON																	
WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY
130	235	1421	1070	25.3	19.8	52.7	75.1	412.4	182.5	3.2	4.7	28.6	5.1	-955.7	-892.6	-1.5	-9.2
150	215	1938	2288	34.5	40.7	62.1	198.4	1253.4	334.1	3.9	12.4	62.7	16.7	-622.4	-1755.6	32.1	-11.6
160	185	5841	3139	103.9	55.8	56.5	180.0	779.9	437.2	3.5	11.2	39.0	21.9	-5005.0	-2522.0	-61.4	-22.7
180	185	1844	884	32.8	15.7	32.8	125.8	2072.5	508.9	2.0	7.9	103.6	25.4	241.5	-249.3	72.8	17.6
120	245	1069	2406	19.0	42.8	60.4	115.1	1017.4	287.0	3.7	7.2	50.9	14.3	8.5	-2004.1	35.6	-21.3
120	245	676	1380	12.0	24.5	85.9	65.4	2597.6	120.9	5.4	4.1	129.9	6.0	2007.8	-1193.2	123.3	-14.4
120	245	765	893	13.6	15.9	129.6	26.2	8802.0	130.1	8.1	1.6	440.1	6.5	8166.5	-736.3	434.6	-7.8

a/ REFER APPENDIX 1 FOR DETAILS ON THE SOURCE OF INFORMATION AND/OR THE CALCULATIONS FOR EACH ITEM.
NOTE : MINOR ERRORS DUE TO ROUNDING.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.5 : INCOME FROM LIVESTOCK

ITEM NO./	1	2	3	4	5	6	7	8	9	10	11
LSINCOME/HA/MTBLC											
CALC.											
	ANIMALS/KM2			%	NO.	PRICE		TOTAL	TOTAL	AMOUNT	AMOUNT
CP	WET	DRY	AVERAGE	HERD	SOLD	PER	GROSS	PEOPLE	FAMILIES	EARNED	EARNED
				SOLD	PER	ANIMAL	INCOME	PER	PER	PER	PER
					KM2	(SS)	(SS)	(AV, W&D)	(AV, W&D)	PERSON	FAMILY
CATTLE	4.4	1.7	3.1	10	0.31	8000	2440				
SHEEP	26.5	14.4	20.5	8	1.64	2400	3926	3.83	0.78	4178	20515
GOATS	43.0	34.9	39.0	10	3.90	2400	9348				
CAMELS	0.6	0.3	0.5	5	0.02	12800	288				
TOTAL	74.5	51.3	62.9		5.9		16002				
APS											
CATTLE	4.5	2.0	3.3	10	0.33	8000	2600				
SHEEP	24.1	24.7	24.4	8	1.95	2400	4685	5.82	1.19	5000	24551
GOATS	56.1	99.3	77.7	10	7.77	2400	18648				
CAMELS	7.3	2.6	5.0	5	0.25	12800	3168				
TOTAL	92	128.6	110.3		10.3		29101				
APC											
CATTLE	0.8	9.4	5.1	10	0.51	8000	4080				
SHEEP	34.1	23.1	28.6	8	2.29	2400	5491	12.21	2.49	2033	9981
GOATS	54.3	50.1	52.2	10	5.22	2400	12528				
CAMELS	4.5	4.0	4.3	5	0.21	12800	2720				
TOTAL	93.7	86.6	90.2		8.2		24819				
WS											
CATTLE	7.5	6.4	7.0	10	0.70	8000	5560				
SHEEP	7.7	6.0	6.9	8	0.55	2400	1315	3.71	0.76	4907	24091
GOATS	17.7	17.5	17.6	10	1.76	2400	4224				
CAMELS	14.7	7.5	11.1	5	0.56	12800	7104				
TOTAL	47.6	37.4	42.5		3.6		18203				
IS											
CATTLE	0.1	1.4	0.8	10	0.08	8000	600				
SHEEP	10.9	9.7	10.3	8	0.82	2400	1978	4.63	0.94	4374	21474
GOATS	72.9	48.5	60.7	10	6.07	2400	14568				
CAMELS	6.1	3.6	4.9	5	0.24	12800	3104				
TOTAL	90.0	63.2	76.6		7.2		20250				

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.5 : INCOME FROM LIVESTOCK

ITEM NO.a/	1	2	3	4	5	6	7	8	9	10	11
LSINCOME/HMNTBLC CALC.											

IDS/G											
CATTLE	9.0	0.3	4.7	10	0.47	8000	3720				
SHEEP	23.6	9.0	16.3	8	1.30	2400	3130	2.78	0.57	9143	44892
GOATS	74.7	32.3	53.5	10	5.35	2400	12840				
CAMELS	16.7	1.2	9.0	5	0.45	12800	5728				

TOTAL	124.0	42.8	83.4		7.6		25418				

NP											
CATTLE	11.3	0.0	5.7	10	0.57	8000	4520				
SHEEP	20.3	0.9	10.6	8	0.85	2400	2034	2.48	0.51	18025	88503
GOATS	126.8	5.5	66.2	10	6.62	2400	15876				
CAMELS	67.2	2.4	34.8	5	1.74	12800	22272				

TOTAL	225.6	8.79	117.2		9.8		44702				
=====											

a/ REFER APPENDIX 1 FOR DETAILS ON THE SOURCE OF INFORMATION AND/OR CALCULATION FOR EACH ITEM.
NOTE : MINOR ERRORS DUE TO ROUNDING.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.6 : HUMAN CALORY AND PROTEIN BALANCE AND GROSS VALUE OF
CROP AND LIVESTOCK PRODUCTION

ITEM CROPBLC NO.a/ CALC.	ITEM	AGROPASTORAL SANDS	AGROPASTORAL CLAYS
1	CROPPED AREA/FAMILY (HA) (BOTH SEASONS)		
	SORGHUM	2.2	2.2
	COW PEA	3.3	3.3
2	YIELD (KG/HA)		
	SORGHUM	415	415
	COW PEA	460	460
3 (1X2)	PROD'N PER FAMILY (KG)		
	SORGHUM	913	913
	COW PEA	1518	1518
4	FAMILIES PER KM2 (AVERAGE, WET AND DRY)	1.19	2.49
5 (3X4)	PRODUCTION/KM2 (KG)		
	SORGHUM	1086	2273
	COW PEA	1806	3780
6	PRICE (SS/KG)		
	SORGHUM	19	19
	COW PEA	24	24
7 (5X6)	VALUE OF PROD'N (SS/KM2)		
	SORGHUM	20643	43194
	COW PEA	43354	90716
	TOTAL	63997	133910
8 (7/4)	VALUE OF PROD'N (SS/FAM.)		
	SORGHUM	17347	17347
	COW PEA	36432	36432
	TOTAL	53779	53779
9	CALORY VALUE (CAL/KG)		
	SORGHUM	3330	3330
	COW PEA	3390	3390
10 (5X9)	TOT. CAL. ('000 CAL/KM2)		
	SORGHUM	3618	7570
	COW PEA	6124	12814
	TOTAL	9742	20384

154

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.6 : HUMAN CALORY AND PROTEIN BALANCE AND GROSS VALUE OF
CROP AND LIVESTOCK PRODUCTION

ITEM CROP/LC NO.a/ CALC.	ITEM	AGROPASTORAL SANDS	AGROPASTORAL CLAYS
11	PROTEIN VALUE (GM/KG)		
	SORGHUM	130	130
	COW PEA	240	240
12 (5X11)	TOTAL PROTEIN (GM/KM2)		
	SORGHUM	141	296
	COW PEA	434	907
	TOTAL	575	1203
13 (T A8.4)	L/STOCK CAL. ('000/KM2)		
	WET SEASON	-622	-5005
	DRY SEASON	-1756	-2522
14 (10-13)	CALORY BALANCE (DRY SEASON) ('000 CAL/KM2)	7986	17862
15 (T A8.4)	LIVESTOCK PROTEIN (GM/KM2)		
	WET SEASON	32	-61
	DRY SEASON	-12	-23
16 (12-15)	PROTEIN BALANCE (DRY SEASON) ('000 GM/KM2)	563	1180
17	INCOME FROM LIVESTOCK/FAMILY (TABLE A8.5)	24551	9981
18	INCOME FROM CROPPING/FAMILY (ITEM 8)	53779	53779
19	TOTAL FAMILY INCOME (SS)	78330	63760

a/ REFER APPENDIX 1 FOR DETAILS ON THE SOURCE OF INFORMATION
AND/OR CALCULATION FOR EACH ITEM.

NOTE : MINOR ERRORS DUE TO ROUNDING.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT. PHASE II
TABLE A8.7 : STATIC SHEEP/GOAT MODEL (1000 HEAD)

SHEEP/STATIC				FEMALES								
AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		
BREED%		0.30	0.80	0.80	0.80	0.80	0.80					
DEATH%	0.27	0.18	0.15	0.15	0.15	0.15	0.15					
SALES%							0.85					
				MALES							MALE	
DEATH%	0.27	0.18	0.15	0.15	0.15	0.15	0.15				RATIO	
SALES%	0.30	0.40	0.50	0.85			0.85				0.05	
CASTRATES												
(NO CASTRATES)												
DEATH%												
SALES%												
A/UNITS												

FEMALES												
AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	TOTAL	
ON		201	165	140	119	101	86	0	0	0	813	
PU											0	
NI	275										275	
DE	74	36	25	21	18	15	13	0	0	0	202	
SA	0	0	0	0	0	0	73	0	0	0	73	
CN	201	165	140	119	101	86	0	0	0	0	813	
MALES												
AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	TOTAL	
ON		118	50	17	0	0	0	0	0	0	185	
PU											0	
NI	275										275	
DE	74	21	7	3	0	0	0	0	0	0	106	
SA	82	47	25	15	0	0	0	0	0	0	169	
CN	118	50	17	0	0	0	0	0	0	0	185	
MALES REQUIRED =				31 MALES AVAILABLE =				67				
CASTRATES												
AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	TOTAL	
ON		0	0	0	0	0	0	0	0	0	0	
PU											0	
NI											0	
DE	0	0	0	0	0	0	0	0	0	0	0	
SA	0	0	0	0	0	0	0	0	0	0	0	
CN	0	0	0	0	0	0	0	0	0	0	0	
TOTAL												
AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	TOTAL	
ON	0	319	215	158	119	101	86	0	0	0	998	
PU	0	0	0	0	0	0	0	0	0	0	0	
NI	550	0	0	0	0	0	0	0	0	0	550	
DE	148	57	32	24	18	15	13	0	0	0	308	
SA	82	47	25	15	0	0	73	0	0	0	242	
CN	319	215	158	119	101	86	0	0	0	0	998	

ON=Opening Number. PU=Purchases. NI=Natural Increase. DE=Deaths. SA=Sales. CN=Closing Number
NOTE : MINOR ERRORS DUE TO ROUNDING.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.8 : SHEEP/GOAT ENERGY DEMAND

SEX/AGE		ME (MJ/DAY)				TOTAL MJ/ANIMAL PER YEAR				TOTAL MJ/YEAR	
AGE CLASS (YEARS)	OPENING NUMBERS a/	MTCE.	GROWTH	PREG	LACTATION (TOTAL MJ)	MTCE.	GROWTH	PREG (80%)	LACTAT'N (80%)	TOTAL	('000) b/
FEMALES											
0-1	275	2.59	0.62	-		945	226			1172	322
1-2	201	3.39	0.62	5.44	224	1237	226	82 (30%)	67 (30%)	1613	324
2-3	165	3.89	0.62	5.28	224	1420	226	213	179	2038	336
3-4	140	3.89	-	5.28	224	1420	0	213	179	1812	254
4-5	119	3.89	-	5.28	224	1420	0	213	179	1812	216
5-6	101	3.89	-	5.28	224	1420	0	213	179	1812	183
6-7	86	3.89	-	5.28	224	1420	0	213	179	1812	156
SUB TOTAL		1087								1791	
MALES											
0-1	275	3.10	0.75	-	-	1131	274	-	-	1405	386
1-2	118	4.02	0.75	-	-	1467	274	-	-	1741	205
2-3	50	4.60	0.75	-	-	1679	274	-	-	1953	98
3-4	17	4.60	0.75	-	-	1679	274	-	-	1953	33
SUB TOTAL		460								723	
TOTAL		1547				TOTAL ENERGY NEEDS : 1547 HEAD. '000MJ/YEAR				2514	

a/ INCLUDING NATURAL INCREASE.

a/ FROM TABLE A8.7.

b/ BASED ON : NUTRIENT REQUIREMENTS OF RUMINANTS IN DEVELOPING COUNTRIES.

L.C. KEARL, DEC. 1982. TABLE 11 (p55) AND TABLE 12 (p67).

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE AB.9 : FORAGE PRODUCTION ON AGROPASTORAL COMPLEXES

FORPROD	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TYPE 1 APC																					
AREA CROPPED (SECTION OF APC) a/		a	a	a	a	a	b	b	b	b	b	c	c	c	c	c	d	d	d	d	d
SECT. PLANTED TO BUFFEL GRASS b/		d					a					b					c				
HA PLANTED TO BUFFEL GRASS		2.75	2.75	2.75	2.75	2.75	5.50	5.50	5.50	5.50	5.50	8.25	8.25	8.25	8.25	8.25	11.00	11.00	11.00	11.00	11.00
INC FORAGE PER HA (t)		1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50
INC. FORAGE FROM BUFFEL (t)		2.75	4.13	4.13	4.13	4.13	6.88	8.25	8.25	8.25	8.25	11.00	12.38	12.38	12.38	12.38	15.13	16.50	16.50	16.50	16.50
TYPE 2 APC																					
AREA CROPPED (SECTION OF APC)		a	a	a	a	b	b	b	b	b	c	c	c	c	c	d	d	d	d	d	a
SECT. PLANTED TO BUFFEL GRASS						a					b					c					d
HA PLANTED TO BUFFEL GRASS						2.75	2.75	2.75	2.75	2.75	5.50	5.50	5.50	5.50	5.50	8.25	8.25	8.25	8.25	8.25	11.00
INC FORAGE PER HA (t)						1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00
INC. FORAGE FROM BUFFEL (t)		0.00	0.00	0.00	0.00	2.75	4.13	4.13	4.13	4.13	6.88	8.25	8.25	8.25	8.25	11.00	12.38	12.38	12.38	12.38	15.13
TYPE 3 APC																					
AREA CROPPED (SECTION OF APC)		a	a	a	b	b	b	b	b	c	c	c	c	c	d	d	d	d	d	a	a
SECT. PLANTED TO BUFFEL GRASS					a					b					c					d	
HA PLANTED TO BUFFEL GRASS					2.75	2.75	2.75	2.75	2.75	5.50	5.50	5.50	5.50	5.50	8.25	8.25	8.25	8.25	8.25	11.00	11.00
INC FORAGE PER HA (t)					1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50
INC. FORAGE FROM BUFFEL (t)		0.00	0.00	0.00	2.75	4.13	4.13	4.13	4.13	6.88	8.25	8.25	8.25	8.25	11.00	12.38	12.38	12.38	12.38	15.13	16.50
TYPE 4 APC																					
AREA CROPPED (SECTION OF APC)		a	a	b	b	b	b	b	c	c	c	c	c	d	d	d	d	d	a	a	a
SECT. PLANTED TO BUFFEL GRASS				a					b					c					d		
HA PLANTED TO BUFFEL GRASS				2.75	2.75	2.75	2.75	2.75	5.50	5.50	5.50	5.50	5.50	8.25	8.25	8.25	8.25	8.25	11.00	11.00	11.00
INC FORAGE PER HA (t)				1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50
INC. FORAGE FROM BUFFEL (t)		0.00	0.00	2.75	4.13	4.13	4.13	4.13	6.88	8.25	8.25	8.25	8.25	11.00	12.38	12.38	12.38	12.38	15.13	16.50	16.50
TYPE 5 APC																					
AREA CROPPED (SECTION OF APC)		a	b	b	b	b	b	c	c	c	c	c	d	d	d	d	d	a	a	a	a
SECT. PLANTED TO BUFFEL GRASS			a					b					c					d			
HA PLANTED TO BUFFEL GRASS			2.75	2.75	2.75	2.75	2.75	5.50	5.50	5.50	5.50	5.50	8.25	8.25	8.25	8.25	8.25	11.00	11.00	11.00	11.00
INC FORAGE PER HA (t)			1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.50
INC. FORAGE FROM BUFFEL (t)		0.00	2.75	4.13	4.13	4.13	4.13	6.88	8.25	8.25	8.25	8.25	11.00	12.38	12.38	12.38	12.38	15.13	16.50	16.50	16.50
AVERAGE OF 5 TYPES OF APCs (TN. OF INC. FORAGE/YEAR/APC)		0.55	1.38	2.20	3.03	3.85	4.68	5.50	6.33	7.15	7.98	8.80	9.63	10.45	11.28	12.10	12.93	13.75	14.58	15.40	16.23

a/ ASSUMED THAT APCs ARE CROPPED ON A 5 YEAR CYCLE, FOLLOWED BY THE PLANTING OF THE BUFFEL GRASS.

b/ FOR EXAMPLE, SECTION d IS PLANTED IN YEAR 1 IN TYPE 1 APC.

NOTE : ASSUMES A 20 YEAR SUSTAINED CYCLE.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.10 : SHEEP/GOAT EXPORT PARITY PRICE (1986 CONSTANT)

	FIN (SS)	ECON(SS)
FOB BERBERA (\$US EA)	36	36
50% 2 SS 85 a/	1530	1530
50% 2 SS 120 a/	2160	2160
TOTAL	3690	3690
ADJUSTED FOR LOW C&F US 8.00 2 SS 120 b/	960	960
ADJUSTED FOB PRICE :	4650	4650
EXPORT TAX (PER HEAD)	185	
TRECKING COSTS c/	155	110 e/
BUYER'S TAX AND LEVY	15	
BUYER'S MARGIN d/	930	660
BUYER'S PRICE	3365	3880
SELLER'S TAX (PER HEAD)	115	
FARMGATE PRICE	3250	3880

a/ CURRENT REGULATION GOVERNING EXCHANGE RATES.

b/ THE DECLARED VALUE IN THE LETTER OF CREDIT (\$US 36) MAY BE BELOW THE ACTUAL PRICE BY \$US 8.

c/ FROM MASCOTT (1986).

d/ DETERMINED DURING FIELD WORK.

e/ SCF = 0.71 (SS85/SS120)

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.11 : INCREMENTAL FORAGE AND LIVESTOCK PRODUCTION PER APC

INCHERO	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TUNNES OF INCREMENTAL																					
FORAGE PER APC PER YEAR a/		0.55	1.38	2.20	3.03	3.85	4.68	5.23	6.05	6.88	7.98	8.80	9.63	10.45	11.28	12.10	12.93	13.75	14.58	15.40	16.23
FORAGE UTILISATION FACTOR b/		0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
MJ/KG DM BUFFEL GRASS c/		8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12
INC. ENERGY ('000 MJ/YEAR)		2.6796	6.7233	10.718	14.762	18.757	22.800	25.480	29.475	33.519	38.878	42.873	46.917	50.912	54.956	58.951	62.994	66.99	71.033	75.028	79.072
ENERGY DEMAND BY STATIC																					
1000 HEAD HERD/FLOCK																					
(000 MJ/YEAR) d/		2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514	2514
INC. HERD/FLOCK UNITS PER APC ('000 HEAD)		0.0011	0.0026	0.0042	0.0058	0.0074	0.0090	0.0101	0.0117	0.0133	0.0154	0.0170	0.0186	0.0202	0.0218	0.0234	0.0250	0.0266	0.0282	0.0298	0.0314
TOTAL HEAD IN STATIC																					
HERD/FLOCK e/		998	998	998	998	998	998	998	998	998	998	998	998	998	998	998	998	998	998	998	998
INC FIN. & ECON. BENEFITS - MEAT																					
INC STOCK NOS. PER APC (LAGGED BY ONE YEAR)																					
	STATIC e/	0.000	1.064	2.669	4.255	5.860	7.446	9.051	10.115	11.701	13.306	15.434	17.020	18.625	20.211	21.816	23.402	25.008	26.593	28.199	29.785
INC SALES PER APC																					
CULL FEMALES	73	0.000	0.078	0.195	0.311	0.429	0.545	0.662	0.740	0.856	0.973	1.129	1.245	1.362	1.478	1.596	1.712	1.829	1.945	2.063	2.179
MALES 0-1	82	0.000	0.087	0.219	0.350	0.482	0.612	0.744	0.831	0.961	1.093	1.268	1.398	1.530	1.661	1.793	1.923	2.055	2.185	2.317	2.447
1-2	47	0.000	0.050	0.126	0.200	0.276	0.351	0.426	0.476	0.551	0.627	0.727	0.802	0.877	0.952	1.027	1.102	1.178	1.252	1.328	1.403
2-3	25	0.000	0.027	0.067	0.107	0.147	0.187	0.227	0.253	0.293	0.333	0.387	0.426	0.467	0.506	0.547	0.586	0.626	0.666	0.706	0.746
3-4	15	0.000	0.016	0.040	0.064	0.088	0.112	0.136	0.152	0.176	0.200	0.232	0.256	0.280	0.304	0.328	0.352	0.376	0.400	0.424	0.448
TOTAL		0.000	0.258	0.647	1.032	1.421	1.806	2.195	2.453	2.837	3.227	3.742	4.127	4.516	4.901	5.290	5.675	6.064	6.449	6.838	7.222
INC. FIN INCOME PER APC (SS'000/HEAD) f/																					
CULL FEMALES	1.8	0	140	351	560	772	980	1192	1332	1541	1752	2032	2241	2452	2661	2872	3081	3293	3501	3713	3922
MALES 0-1	1.2	0	105	263	420	578	734	892	997	1154	1312	1522	1678	1836	1993	2151	2307	2466	2622	2780	2937
1-2	2.2	0	110	277	441	607	771	938	1048	1212	1379	1599	1763	1930	2094	2260	2425	2591	2755	2922	3086
2-3	3.53	0	94	236	376	518	658	800	894	1035	1177	1365	1505	1647	1787	1929	2069	2211	2352	2494	2634
3-4	3.53	0	56	142	226	311	395	480	537	621	706	819	903	988	1072	1157	1242	1327	1411	1496	1580
TOTAL (SS/APC)		0	506	1269	2023	2786	3540	4303	4808	5562	6325	7337	8090	8853	9607	10370	11124	11887	12641	13404	14158
INC ECON. INCOME/APC (SS'000/HEAD) g/																					
CULL FEMALES	1.27	0	99	250	398	548	696	846	946	1094	1244	1443	1591	1741	1889	2039	2188	2338	2486	2636	2784
MALES 0-1	0.85	0	74	187	298	410	521	634	788	819	932	1080	1191	1304	1415	1527	1638	1751	1862	1974	2085
1-2	1.56	0	78	196	313	431	548	666	744	861	979	1135	1252	1370	1487	1605	1721	1840	1956	2074	2191
2-3	2.92	0	78	195	311	429	545	662	740	856	973	1129	1245	1362	1478	1596	1712	1829	1945	2063	2179
3-4	2.92	0	47	117	187	257	327	397	444	514	584	677	747	817	887	957	1027	1098	1167	1238	1307
TOTAL ECON. BENEFITS - MEAT		0	377	945	1587	2875	2637	3205	3582	4143	4712	5465	6266	6595	7156	7725	8286	8855	9416	9985	10546
INC ECON. BENEFITS - MILK																					
INC STOCK NOS. PER APC (LAGGED BY ONE YEAR)																					
		0.000	1.064	2.669	4.255	5.860	7.446	9.051	10.115	11.701	13.306	15.434	17.020	18.625	20.211	21.816	23.402	25.008	26.593	28.199	29.785
PROP'N LACTATING		0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
PROP'N OF GOATS (ESTIMATE)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
INC. GOATS LACTATING		0.000	0.439	1.101	1.755	2.417	3.072	3.734	4.173	4.827	5.489	6.366	7.021	7.683	8.337	8.999	9.653	10.316	10.970	11.632	12.286
LITRES PER LACTATION																					
(AVAILABLE FOR HUMANS)		40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
INC MILK (LITRES)		0.0	17.6	44.0	70.2	96.7	122.9	149.3	166.9	193.1	219.6	254.7	280.8	307.3	333.5	360.0	386.1	412.6	438.8	465.3	491.4
PRICE (SS/LIT) (ECON.) g/		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
INC ECON. BENEFITS - MILK		0	263	661	1053	1450	1843	2240	2504	2896	3293	3820	4212	4610	5002	5400	5792	6189	6582	6979	7372
TOT INC. ECON. BENEFITS (SS)		0	640	1606	2560	3525	4479	5445	6085	7039	8005	9285	10239	11204	12159	13124	14078	15044	15998	16964	17918

a/ FROM TABLE A8.9.

b/ ALLOWS FOR 40% WASTAGE.

c/ AVERAGE OF FRESH AND DRY FORAGE. SAME REFERENCE AS FOR TABLE A8.8.

d/ FROM TABLE A8.8.

e/ FROM TABLE A8.7.

f/ FINANCIAL PRICE

g/ FINANCIAL PRICE ADJUSTED BY STANDARD CONVERSION FACTOR (NON-TRADED PRODUCTS) AND ECONOMIC PRICE FOR EXPORTED STOCK.

(REFER NOTES ON METHODOLOGY FOR DETAILS).

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.12 : FAMILY UNIT CROP MODEL, AGROPASTORAL SYSTEM

CROP SEASON CROP/MODEL	SORGHUM a/						COW PEA b/						MUNG BEAN c/						GROSS VALUE OF PRODUCTION			TOTAL INCOME PER YEAR	INC. INCOME PER YEAR
	GU			DAYR			GU			DAYR			GU			DAYR			SORGHUM (SS19/KG)	COW PEA (SS24/KG)	M.BEAN (SS36/KG)	(SS)	(SS)
	AREA (HA)	YIELD (KG/HA)	PROD. (KG)	AREA (HA)	YIELD (KG/HA)	PROD. (KG)	AREA (HA)	YIELD (KG/HA)	PROD. (KG)	AREA (HA)	YIELD (KG/HA)	PROD. (KG)	AREA (HA)	YIELD (KG/HA)	PROD. (KG)	AREA (HA)	YIELD (KG/HA)	PROD. (KG)					
WITHOUT PROJECT	0.55	415	228	1.65	415	685	2.20	530	1164	1.10	338	363	-	-	-	-	-	-	17347	36696		54843	
WITH PROJECT																							
YEAR 1	0.55	415	228	1.65	415	685	2.07	780	1449	1.03	405	417	0.13	260	34	0.07	200	14	17347	44788	1721	63855	9812
YEAR 2	0.55	415	228	1.65	415	685	1.94	725	1407	0.96	430	413	0.26	289	73	0.14	215	38	17347	43663	3704	64714	10672
YEAR 3	0.55	415	228	1.65	415	685	1.81	750	1358	0.89	450	401	0.39	300	117	0.24	230	55	17347	42192	6199	65738	11695
YEAR 4	0.55	415	228	1.65	415	685	1.68	775	1382	0.82	475	390	0.52	310	161	0.28	248	67	17347	40596	8222	66165	12122
YEAR 5-20	0.55	415	228	1.65	415	685	1.54	800	1232	0.77	495	381	0.66	325	215	0.33	250	83	17347	38716	10692	66754	12712

TOTAL AREA CROPPED EACH YEAR : 2.75 HA. WITH MIX OF CROPS CHANGING AS NEW VARIETIES AND CROPS ARE INTRODUCED.

a/ AREA OF SORGHUM WOULD REMAIN CONSTANT.

b/ INTRODUCTION OF NEW VARIETY WOULD RESULT IN INCREASED YIELDS.

c/ MUNG BEAN WOULD BE PROMOTED AS A NEW ALTERNATIVE CROP TO COW PEA.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.13 : PHASING OF AGROPASTORAL COMPLEXES

PHASE/AGR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VEWS IN AGROPAST. SYSTEMS a/	24	30	36	41	47	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
NO. OF FAMILIES/VEW	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
NO. OF FAMILIES/VEW (CUM.) b/	80	80	160	160	240	240	320	320	400	400	480	480	560	560	640	640	720	720	800	800
TOTAL FAMILIES ASSISTED	INC. VIEWS																			
YEAR	-----																			
1	24	1920	1920	3840	3840	5760	5760	7680	7680	9600	9600	11520	11520	13440	13440	15360	15360	17280	17280	19200
2	6		480	480	960	960	1440	1440	1920	1920	2400	2400	2880	2880	3360	3360	3840	3840	4320	4800
3	6			480	480	960	960	1440	1440	1920	1920	2400	2400	2880	2880	3360	3360	3840	3840	4320
4	5				400	400	800	800	1200	1200	1600	1600	2000	2000	2400	2400	2800	2800	3200	3600
5	6					480	480	960	960	1440	1440	1920	1920	2400	2400	2880	2880	3360	3360	3840
6	6						480	480	960	960	1440	1440	1920	1920	2400	2400	2880	2880	3360	3840
TOTAL		1920	2400	4800	5680	8560	9920	12800	14160	17040	18400	21280	22640	25520	26880	29760	31120	34000	35360	39600
INCREMENTAL FAMILIES		1920	480	2400	880	2880	1360	2880	1360	2880	1360	2880	1360	2880	1360	2880	1360	2880	1360	1360
ACCEPTANCE FACTOR c/		0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
INC. FAMILIES ACCEPTING INTERVENTIONS		960	240	1440	528	2016	952	2304	1088	2304	1088	2304	1088	2304	1088	2304	1088	2304	1088	1088

a/ NOTE : NOT ALL VILLAGE EXTENSION WORKERS WOULD WORK IN THE AGROPASTORAL SYSTEMS.

b/ EACH VEW WOULD ASSIST 80 FAMILIES FOR TWO YEARS AND THEN SELECT ANOTHER 80 FAMILIES.

c/ PROPORTION OF FAMILIES CONTACTED BY VEWs WHICH ACCEPT DEVELOPMENT INTERVENTIONS.

162

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.14 : PHASING AND BENEFITS FROM DEWORMING STRATEGY

DEWORM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NO. OF NAHA ^a OPERATIONAL ^{a/}	60	75	90	105	120	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135
NO. OF FAMILIES/NAHA/YEAR	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
NO. OF FAM/NAHA/YEAR (CUM)	50	100	150	200	250	300	350	400	450	500	550	600	600	600	600	600	600	600	600	600
NO. OF FAMILIES CONTINUING TO ACCEPT DE-WORMING/NAHA		25	50	75	100	125	150	175	200	225	250	275	300	300	300	300	300	300	300	300
INC FAMILIES /NAHA USING DEWORMING	INC.	50	75	100	125	150	175	200	225	250	275	300	325	350	400	400	400	400	400	400
TOTAL FAMILIES DE-WORMING YEAR	NAHA ^a																			
1	60	3000	4500	6000	7500	9000	10500	12000	13500	15000	16500	18000	19500	21000	24000	24000	24000	24000	24000	24000
2	15		750	1125	1500	1875	2250	2625	3000	3375	3750	4125	4500	4875	5250	6000	6000	6000	6000	6000
3	15			750	1125	1500	1875	2250	2625	3000	3375	3750	4125	4500	4875	5250	6000	6000	6000	6000
4	15				750	1125	1500	1875	2250	2625	3000	3375	3750	4125	4500	4875	5250	6000	6000	6000
5	15					750	1125	1500	1875	2250	2625	3000	3375	3750	4125	4500	4875	5250	6000	6000
6	15						750	1125	1500	1875	2250	2625	3000	3375	3750	4125	4500	4875	5250	6000
TOTAL FAMILIES DE-WORMING EACH YEAR		3000	5250	7875	10875	14250	18000	21375	24750	28125	31500	34875	38250	41625	46500	48750	50625	52125	53250	54000
FAMILIES PER PROD'N SYSTEM	%																			
COASTAL PLAINS	20.3	609	1066	1599	2208	2893	3654	4339	5024	5709	6395	7080	7765	8450	9440	9896	10277	10581	10810	10962
AGROPASTORAL SANDS	21.6	648	1134	1701	2349	3078	3888	4617	5346	6075	6804	7533	8262	8991	10044	10530	10935	11259	11502	11664
AGROPASTORAL CLAYS	58.1	1743	3050	4575	6318	8279	10458	12419	14380	16341	18302	20262	22223	24184	27017	28324	29413	30285	30938	31374
SALES PER FAMILY b/	W. SEASON NOS.																			
COASTAL PLAINS	46 S/6				40				1.843					4		120	97		885	715
AGROPASTORAL SANDS	50 S/6				40				2.004					4		120	97		962	778
AGROPASTORAL CLAYS	21 S/6				40				0.841					4		120	97		484	327
TOTAL INC. INCOME (\$\$ '000)	SS/FAM																			
COASTAL PLAINS	885	539	943	1415	1954	2560	3234	3840	4446	5053	5659	6265	6872	7478	8354	8758	9095	9364	9566	9701
AGROPASTORAL SANDS	962	623	1091	1636	2268	2961	3740	4442	5143	5844	6545	7247	7948	8649	9662	10130	10519	10831	11065	11221
AGROPASTORAL CLAYS	404	704	1232	1848	2553	3345	4225	5017	5809	6602	7394	8186	8978	9770	10915	11443	11883	12235	12499	12675
TOTAL		1866	3266	4900	6766	8866	11199	13299	15399	17498	19598	21698	23798	25898	28931	30331	31497	32430	33130	33597
NET INCOME/FAMILY	COST/HEAD (SS) (FIN)																			
COASTAL PLAINS	20				11				37		20		848		695					
AGROPASTORAL SANDS	20				11				40		22		922		756					
AGROPASTORAL CLAYS	20				11				17		9		387		317					
NET ECONOMIC BENEFITS (\$\$'000) c/																				
COASTAL PLAINS	423	741	1111	1534	2011	2540	3016	3492	3968	4445	4921	5397	5873	6561	6879	7143	7355	7514	7619	7619
AGROPASTORAL SANDS	490	857	1285	1775	2325	2937	3488	4039	4590	5140	5691	6242	6793	7588	7956	8262	8506	8690	8812	8812
AGROPASTORAL CLAYS	553	968	1452	2005	2627	3318	3941	4563	5185	5807	6430	7052	7674	8573	8988	9333	9610	9817	9955	9955
TOTAL d/		1466	2565	3848	5314	6963	8796	10445	12094	13743	15392	17042	18691	20340	22722	23822	24738	25471	26021	26387

^{a/} NOMADIC ANIMAL HEALTH ASSISTANTS.

^{b/c/} REFER TO NOTES ON METHODOLOGY FOR DETAILS ON FINANCIAL AND ECONOMIC PRICES.

^{d/} THE ECONOMIC ANALYSIS ASSUMES ZERO BENEFITS IN YEARS 1-3, BECAUSE INPUTS FUNDED BY GTZ IN THESE YEARS HAVE NOT INCLUDED.

NOTE : ASSUMES THAT ALL DEWORMED SHEEP/GOATS ARE SOLD FOR EXPORT.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.15 : BENEFITS FROM WATER DEVELOPMENT

WATERBEN	YEAR	1	2	3	4	5	6	7	8	9	10	11-20
1. CALCULATED FROM INCREMENTAL WATER												
PHASE I BORE HOLES	UNIT											
WATER PRODUCTION												
WITH ENGINES/PUMPS (7)	('000 M3)	0	2	3	4	7	10	17	27	43	70	70
WITH WINDMILLS (3)	('000 M3)	0	0	0	0	0	1	1	1	1	1	1
PHASE II BORE HOLES (INC NO.)												
WATER PRODUCTION												
WITH ENGINES/PUMPS	('000 M3)	0	20	40	80	100	140	160	160	160	160	160
WITH WINDMILLS	('000 M3)	0	1	1	1	1	1	1	1	1	1	1
PHASE I DUGOUTS (20)												
WATER PRODUCTION	('000 M3)	0	0	2	3	4	6	8	12	16	20	20
PHASE II DUGOUTS (INC. NO.)	1.2	10	25	40	55	70	70	70	70	70	70	70
WATER PRODUCTION	('000 M3)	0	12	30	48	66	84	84	84	84	84	84
TOTAL UNADJUSTED INC. WATER	('000 M3)	0	35	76	136	178	242	271	285	305	336	336
TOTAL ADJUSTED INC. WATER a/	('000 M3)	0	21	46	82	107	145	163	171	183	202	202
INC. S/G @ .660 M3/YEAR/S-G	('000 TLUs)	0.00	31.82	69.09	123.64	161.82	220.00	246.36	259.09	277.27	305.45	305.45
% PROJECT AREA POPULAT'N		0.00	0.13	0.29	0.51	0.67	0.91	1.02	1.07	1.15	1.26	1.26
TURNOFF @ 24.2% (LAGGED 1 YR) b/('000 HEAD)		0.00	0.00	7.70	16.72	29.92	39.16	53.24	59.62	62.70	67.10	73.92
INC BENEFITS (MEAT) (ECON)	(SS'000)	0	0	11219	24361	43593	57056	77571	86866	91354	97765	107701
(ECON PRICE : SS 1442/HEAD) c/	1457											
INC. MILK PRODUCTION (ECON)	(SS'000)											
(ECON PRICE : SS 15/LIT) d/		0	0	8078	17540	31387	41080	55851	62544	65775	70391	77545
TOTAL ECON BENEFITS	(SS'000)	0	0	19297	41901	74981	98137	133422	149410	157129	168155	185246
2. CALCULATED FROM INCREMENTAL FORAGE (REFER ANNEX 5)												
INC. AREA AVAILABLE FOR GRAZING (SQ KM)	8100											
(30% OF AREA CURRENTLY WITHOUT WATER SUPPLIES)												
ADDITIONAL FORAGE USED : EQUIVALENT TO ANNUAL PRODUCTION FROM 2000 - 3000 SQ KM.												
INC. IN PROJECT AREA L/STOCK POPULAT'N (%)	0.00	0.16	0.32	0.48	0.64	0.80	0.96	1.12	1.28	1.44	1.60	
INC SHEEP/GOATS ('000)	0.00	38.74	77.47	116.21	154.94	193.68	232.42	271.15	309.89	348.62	387.36	
TURNOFF @ 24.2% (LAGGED 1 YR) b/('000 HEAD)	0.00	0.00	9.37	18.75	28.12	37.50	46.87	56.24	65.62	74.99	84.37	
INC BENEFITS (MEAT) (ECON)	(SS'000)	0	0	13658	27316	40974	54632	68290	81948	95607	109265	122923
(ECON PRICE : SS 1442/HEAD) c/	1457											
INC. MILK PRODUCTION (ECON) d/ (SS'000)		0	0	9834	19668	29501	39335	49169	59003	68837	78671	88504
(ECON PRICE : SS 15/LIT) e/												
TOTAL ECON BENEFITS	(SS'000)	0	0	23492	46984	70476	93968	117459	140951	164443	187935	211427

NOTE : BENEFITS CALCULATED FROM INCREMENTAL FORAGE USED FOR PROJECT ANALYSIS.

a/ ALLOWS FOR 40% WASTAGE AND USE BY PEOPLE.

b/ REFER TABLE A8.7.. NOTE: INCREMENTAL TURNOFF BASED ON SHEEP/GOAT MODEL FOR SIMPLICITY; TURNOFF LAGGED BY 1 YEAR.

c/ WEIGHTED AVERAGE OF PRICES FOR ALL CLASSES OF SHEEP/GOATS SOLD.

d/ REFER NOTES ON METHODOLOGY FOR CALCULATION OF ECONOMIC PRICE OF MILK.

e/ REFER TABLE FOR A8.11 FOR CALCULATION OF RATIO OF ECONOMIC BENEFITS FROM MEAT AND MILK.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.16 : CUMULATIVE BENEFITS FROM CROPPING ON AGROPASTORAL COMPLEXES

ASSCALE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20
BENEFITS/FAMILY (FINAN.) a/	9812	10672	11495	12122	12712	12712	12712	12712	12712	12712	12712	12712	12712	12712	12712	12712	12712	12712	12712	12712
BENEFITS/FAMILY (ECON.) b/	6967	7577	8383	8607	9026	9026	9026	9026	9026	9026	9026	9026	9026	9026	9026	9026	9026	9026	9026	9026
INC FAMILIES																				
YEAR	NO.OF FAM. c/																			
1	960	6488	7274	7971	8262	8664	8664	8664	8664	8664	8664	8664	8664	8664	8664	8664	8664	8664	8664	8664
2	240		1672	1819	1993	2066	2166	2166	2166	2166	2166	2166	2166	2166	2166	2166	2166	2166	2166	2166
3	1440			18032	10911	11957	12394	12997	12997	12997	12997	12997	12997	12997	12997	12997	12997	12997	12997	12997
4	528				3678	4001	4384	4544	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765
5	2016					14045	15275	16740	17351	18195	18195	18195	18195	18195	18195	18195	18195	18195	18195	18195
6	952						6632	7213	7905	8194	8592	8592	8592	8592	8592	8592	8592	8592	8592	8592
7	2304								16051	17458	19131	19830	20795	20795	20795	20795	20795	20795	20795	20795
8	1088									7580	8244	9034	9364	9820	9820	9820	9820	9820	9820	9820
9	2304										16051	17458	19131	19830	20795	20795	20795	20795	20795	20795
10	1088											7580	8244	9034	9364	9820	9820	9820	9820	9820
11	2304												16051	17458	19131	19830	20795	20795	20795	20795
12	1088													7580	8244	9034	9364	9820	9820	9820
13	2304														16051	17458	19131	19830	20795	20795
14	1088															7580	8244	9034	9364	9820
15	2304																16051	17458	19131	19830
16	1088																	7580	8244	9034
17	2304																		16051	17458
18	1088																			7580
19	2304																			
20	1088																			
TOTAL (\$5'000) d/	6688	8946	19822	24845	48732	49516	68376	78886	98408	109282	128965	139896	159588	170511	190194	201125	220809	231740	251424	262334

a/ FROM TABLE A8.12.

b/ FROM TABLE A8.12.. ADJUSTED BY SCF OF 0.71.

c/ FROM TABLE A8.13.

d/ ECONOMIC BENEFITS.

164

165

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A 8.17 : CUMULATIVE BENEFITS FROM FORAGE DEVELOPMENT AND LIVESTOCK PRODUCTION ON APCs

LSSCALE BENEFITS/FAMILY (ECON.) a/	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20
	0	640	1606	2560	3525	4479	5445	6085	7039	8005	9285	10239	11204	12159	13124	14078	15044	15998	16964	17918
INC FAMILIES																				
YEAR	NO. OF FAM. b/																			
1	960	0	614	1542	2458	3384	4300	5227	5842	6757	7685	8914	9829	10756	11473	12599	13515	14442	15358	16285
2	240		0	154	385	614	846	1075	1307	1460	1689	1921	2228	2457	2689	2918	3150	3379	3611	3840
3	1440			0	922	2313	3686	5076	6450	7841	8762	10136	11527	13370	14744	16134	17509	18899	20272	21663
4	528				0	338	848	1352	1861	2365	2875	3213	3717	4227	4902	5406	5916	6420	6929	7433
5	2016					0	1298	3238	5161	7186	9030	10977	12267	14191	16138	18719	20442	22587	24513	26458
6	952						0	409	1529	2437	3356	4264	5184	5793	6701	7621	8839	9748	10666	11575
7	2304							0	1475	3700	5898	8122	10320	12545	14020	16218	18444	21393	23591	25814
8	1088								0	696	1747	2785	3835	4873	5924	6620	7658	8709	10102	11140
9	2304									0	1475	3700	5898	8122	10320	12545	14020	16218	18444	21393
10	1088										0	696	1747	2785	3835	4873	5924	6620	7658	8709
11	2304											0	1475	3700	5898	8122	10320	12545	14020	16218
12	1088												0	696	1747	2785	3835	4873	5924	6620
13	2304													0	1475	3700	5898	8122	10320	12545
14	1088														0	696	1747	2785	3835	4873
15	2304															0	1475	3700	5898	8122
16	1088																0	696	1747	2785
17	2304																	0	1475	3700
18	1088																		0	696
19	2304																			0
20	1088																			0
TOTAL (\$5'000) c/	0	614	1695	3765	6649	10970	16577	23624	32364	42517	54728	68028	83516	100066	118957	138891	161137	184363	209871	236346

a/ FROM TABLE A8.11.

b/ FROM TABLE A8.13.

c/ ECONOMIC BENEFITS.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.18 : SUMMARY OF ECONOMIC ANALYSIS

TOTSCALE

REF TABLE																					
BENEFITS	NO.	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20
AGROPAST. L/STOCK PROD'N.	A8.17	0	614	1695	3765	6649	10970	16577	23624	32364	42517	54728	68028	83516	100046	118957	138891	161137	184363	209871	236346
AGROPAST. CROPPING	A8.16	6688	8946	19822	24845	40732	49516	68376	78886	98408	109282	128965	139896	159580	170511	190194	201125	220809	231740	251424	262354
WATER DEVELOPMENT	A8.15	0	0	23492	46984	70476	93968	117459	140951	164443	187935	211427	211427	211427	211427	211427	211427	211427	211427	211427	211427
STRATEGIC DEMORNING (a)	A8.14	0	0	0	5314	6963	8796	10445	12094	13743	15392	17042	18691	20340	22722	23822	24738	25471	26021	26387	26387
TOTAL ECON. BENEFITS (SS'000)		6688	9560	45009	80908	124820	163250	212857	255555	308958	355126	412162	438042	474863	504726	544400	576181	618844	653551	699109	736514
COSTS																					
ADMINISTRATION	A7.8/9	152698	41647	39438	62532	43795	30146	15401	15401	15401	15401	15401	15401	15401	15401	15401	15401	15401	15401	15401	15401
FIELD SERVICES	A7.10/11	136732	105316	89839	120311	85811	85505	62344	62344	62344	62344	62344	62344	62344	62344	62344	62344	62344	62344	62344	62344
RANGE MANAGEMENT	A7.12/13	36493	15985	18429	15575	17479	13810	283	283	283	283	283	283	283	283	283	283	283	283	283	283
SIMP	A7.14	52206	4525	6466	2706	3935	2099	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RANGE LIVESTOCK SERVICES	A7.15	53386	52755	52841	66621	39199	15440	5574	5574	5574	5574	5574	5574	5574	5574	5574	5574	5574	5574	5574	5574
EXTENSION	A7.16/17	62538	33114	27980	40475	27202	27524	11378	11378	11378	11378	11378	11378	11378	11378	11378	11378	11378	11378	11378	11378
AGROPASTORAL	A7.18/19	88846	25290	26915	33896	23125	23770	7217	7217	7217	7217	7217	7217	7217	7217	7217	7217	7217	7217	7217	7217
LIVESTOCK PRODUCTION	A7.20	27631	5311	1650	6011	6011	6011	3472	3472	3472	3472	3472	3472	3472	3472	3472	3472	3472	3472	3472	3472
WATER DEVELOPMENT	A7.21/22	23927	34750	35677	36689	38922	21721	11601	11601	11601	11601	11601	11601	11601	11601	11601	11601	11601	11601	11601	11601
TRAINING	A7.23	26510	19099	17957	17410	15136	948	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL ECONOMIC COSTS (SS'000)		660967	337792	317192	402226	300615	226974	117270	117270	117270	117270	117270	117270	117270	117270	117270	117270	117270	117270	117270	117270
NET ECONOMIC BENEFIT		-654279	-328232	-272183	-321318	-175795	-63724	95587	138285	191688	237856	294892	320772	357593	387456	427130	458911	501574	536281	581839	619244
ECONOMIC RATE OF RETURN		8.9 %																			

(a) BENEFITS FROM STRATEGIC DEMORNING COMPONENT IN THE FIRST 3 YEARS NOT COUNTED AS COSTS FOR THIS PERIOD FUNDED INDEPENDENTLY BY GTZ.

SOMALI DEMOCRATIC REPUBLIC
CENTRAL RANGELANDS DEVELOPMENT PROJECT, PHASE II
TABLE A8.19 : SENSITIVITY ANALYSIS AND SWITCHING VALUES

	<u>Economic Rate of Return</u>
Basic assumptions	8.9%
Benefits up 10%	10.3%
Costs down 10%	10.5%
Benefits up and costs down	11.9%
Benefits down 10%	7.4%
Costs up 10%	7.5%
Benefits down 10% and costs up 10%	6.0%
Benefits lagged 1 year	6.9%
Benefits down 10% and lagged, costs up 10%	4.3%
Reduction in benefits to reduce economic rate of return to zero	- 46%
Increase in costs to reduce economic rate of return to zero	+ 86%

SUPPORTING NOTES FOR PRODUCTION SYSTEM SUB-MODELS

A. SUPPORTING NOTES FOR FORAGE BALANCE SUB-MODEL

Item No. ^{1/}

1. Production System: Coastal Plain (CP); Agro-Pastoral Sands (APS); Agro-Pastoral Clays (APC); Western Shebelle (WS); Interior Shrubland (IS); Interior Dwarf Shrubland/Grassland (IDS/G); Northern Plateau (NP).
2. Rainfall (mm/yr): Resource Management and Research (1979), Central Rangelands Survey, Somali Democratic Republic Vol. 1, part 3, 32p (maps).
3. Dashmukh, I.K., 1984. A common relationship between precipitation and grassland biomass for East and Southern Africa, Afr. J. Ecol. 22, 181-186.
4. Assumes that peak forage = primary productivity.
5. Available forage biomass (kg/km²/yr), based on:-
 - (a) Per cent of total herbaceous and shrubby vegetation which is palatable (80% for herbs and 68% for shrubs). Palatability ratings are from Herlocker, D., and Kuchar, P., 1986. Palatability ratings of range plants in Ceel Dheer and Bula Burti district. CRDP Tech. Report No. 9, 18p.
 - (b) A proper use factor of 50% (Barker pers. comm.; Lusgi (editor), 1984. Integrated resource assessment and management plan for Eastern Marsabit district, Northern Kenya. Part I. UNESCO, IPAL, Tech. Report A-6, 291p. No data given, probably transposed directly from USA experience.
- 6-10. Cattle, sheep, goats and camels and totals respectively. Livestock numbers from RMR (1979). Central Rangelands Survey. Somali Democratic Republic. Census results maps, wet season, 1979. Vol. 3, part 2. Mean biomass per livestock type from RMR (1979). Central Rangelands Survey. Census results and maps. Dry season, 1979. Vol. 2, part 10, cattle (180 kg); small stock (16 kg); camels (304 kg).
- 11-12. Daily dry matter forage requirements: wet season; 3% of body weight; dry season; 5% of body weight. References:-
 - (a) Field, C., 1981. Livestock Ecology Studies pp33-79. In IPAL Tech. Report A-4; UNESCO, Nairobi.
 - (b) Field, C., 1980. A Summary of Livestock Studies Within the Mt. Kulal Study Area. pp89-123. In: Proceedings of a Scientific Seminar. IPAL Tech. Report A-3; UNESCO, Nairobi.
 - (c) Schwartz, H.J., and Said, A.N., 1981. Dietary preferences of goats and nutritive value of forage on semi-arid pastures in Northern Kenya. pp515-524. In: Nutrition and Systems of Goat Feeding. ITOVIC; INRA International Symposium. Tour, Franco.

^{1/} The Item No. refers to the Item No. listed in the models, e.g. No. 3 refers to Item No. 3 in Table A8.1 (Forage Balance Sub-Model).

13. Duration (days) of wet and dry seasons for entire year.
 - (a) Leroux, M., 1983. The Climate of Tropical Africa. Atlas, Champion, Paris.
 - (b) Inventory of Sand Movement in Somalia UNSO/DEP/SOM/80/001.
14. (12 x 13).
15. Total wet and dry season grazing areas. Wet season grazing area is the total area of each production system. It assumes that all livestock can graze anywhere within the system in the wet season. The dry season grazing area is the area which is within a 20 km radius of permanent water. It is assumed that all livestock remain within this area during the dry season.
16. Total forage requirements (kg) for all stock for the entire production system for both rainy seasons and both dry seasons.
17. Total forage available (15 x 5).
18. Total forage remaining (17 - 16).
19. Forage remaining (kg/km²) (18/15).
20. Forage remaining (kg/ha) (19/100).

B. SUPPORTING NOTES FOR MEAT AND MILK PRODUCTION SUB-MODELS

1. MEAT PRODUCTION SUB-MODEL

Item No.^{1/}

1. No. of livestock/km² - RMR (1979). Census results, 1979. Central Rangelands Survey, Somali Democratic Republic. Vol. 2, part 2. Mean Biomass per Livestock Type.
2. As for 1.
3. Per cent of herd consumed locally. From: Hargus, W.A., and Ali, A.F., 1985. Livestock management and human and animal health conditions in the intra-riverine areas of Somalia: Rehabilitation of Rural Water Reservoirs. Project SOM/83/001, Field Document No. 3, NRA/FAD.
4. Estimate by project staff.
5. Estimate by project staff.
6. (1 x 4).
7. (2 x 5).
8. Based on animal weights from RMR (1979).
9. (6 x 8).

^{1/} The Item No. refers to the Item No. listed in the models, e.g. No. 3 refers to Item No. 3 in Table A8.2 (meat Production Sub-Model).

10. (7 x 8).
11. Thetford (pers. comm.).
12. (9 x 11).
13. (10 x 11).
14. Calorie value of red meat, 2,400 cal/kg.
15. (12 x 14).
16. (13 x 14).
17. Protein value of red meat, 150 gm/kg.
18. (12 x 17).
19. (13 x 17).

2. MILK PRODUCTION SUB-MODEL

Item No.^{1/}

1. No. of livestock/km² - RMR (1979). Census results, 1979. Central Rangelands Survey. Somali Democratic Republic, Vol. 2, part 2, Mean Biomass per Livestock Type.
2. As for 1.
3. Refer 6-7-8 below.
4. (1 x 3).
5. (2 x 3).
- 6-7-8. Milk available for human consumption (l/an/yr) once calves, kids and lambs have been fed. References are:-
 - (a) Field, C., 1981 (refer A, 11-12 (a)-(b)).
 - (b) UNESCO, 1979. Tropical Grazing Lands Ecosystems. Paris, 655p.
 - (c) Aden, Mohamed, D. (pers. comm.).
 - (d) Abdirizak, M. Ali and Hargus, W.A., 1986. Livestock Management Techniques in the Bula Burti district, CRDP Technical Report No. 18.
 - (e) Schwartz, H.J., Wilson, A.J., Dolan, R., Evans, J.V., and Fairfall J. (unpublished data).
9. (7 x 4).
10. (8 x 5).
11. 700 calories/kg milk.
12. (9 x 11).

^{1/} The Item No. refers to the Item No. listed in the models, e.g. No. 3 refers to Item No. 3 in Table A8.3 (Milk Production Sub-Model).

13. (10 x 11).
14. 35 gm of protein/kg.
15. (9 x 14).
16. (10 x 14).

General References for B1 and B2

- (a) Cooper et al, 1958. Nutrition in Health and Disease. Lippincott.
(b) Johnke, H.E., 1982. Livestock Production Systems and Livestock Development in Tropical Africa. Kieler Wissenschaftsverlag Vauk, 253p.

C. SUPPORTING NOTES FOR HUMAN CALORIE AND PROTEIN BALANCE SUB-MODEL

Item No.^{1/}

1. No. of nomadic houses/km²; Resource Management and Research (1979). Central Rangelands Survey, Somali Democratic Republic. Vol. 1, part 3, 32p. Areas of production zones obtained by dot gridding.
2. As for 1.
3. 4.5 people/nomadic hut from RMR (1979). Central Rangelands Survey. Somali Democratic Republic, Vol. 4, Dynamic Range Resources: Methods and Comments.
4. (1 x 3).
5. (2 x 3).
6. As for 3.
7. As for 3, but 5.32 people/nomadic hut.
8. (6 x 7).
9. (4 + 8).
10. (5 + 8).
11. 2,024 calories/person/day.
12. (9 x 11).
13. (10 x 11).
14. 36 gms of protein/person/day.
15. (9 x 14).
16. (10 x 14).

^{1/} The Item No. refers to the Item No. listed in the models, e.g. No. 3 refers to Item No. 3 in Table A8.4 (Human Calorie and Protein Balance Sub-Model).

17. Days/season (wet).
18. Days/season (dry).
19. (12 x 17).
20. (13 x 18).
21. (15 x 17).
22. (16 x 18).
- 23-26. From Table A8.2 and Table A8.3.
- 27-30. From Table A8.2 and Table A8.3.
31. (19-23-25).
32. (20-24-26).
33. (21-27-29).
34. (22-28-30).

D. SUPPORTING NOTES FOR LIVESTOCK INCOME SUB-MODEL

Item No.^{1/}

- 1-2. No. of livestock/km² - RMR (1979). Census Results, 1979. Central Rangelands Survey, Somali Democratic Republic, Vol. 2, part 2, Mean Biomass per Livestock Type.
3. (1/2).
4. From; Hargus, W.A. and Ali, A.F., 1985. Livestock management and human and animal health conditions in the intra-riverine areas of Somalia: Rehabilitation of Rural Water Reservoirs. Project SOM/83/001, Field Document No. 3, NRA/FAD.
5. (3 x 4).
6. Price/animal; obtained from local Mogadishu market; adjusted to "farm-gate" prices.
7. (5 x 6).
8. Total people/km², from Table A8.4, Items 9 and 10 (average of wet season and dry season numbers).
9. No. of families/km²; divide by 4.91 (no. of Nomad people/house) - from RMR (1979), Central Rangelands Survey. Somali Democratic Republic, Vol. 4, Dynamic Range Resources: Methods and Comments, adjusted to reflect permanent houses - 4.91 is average of 4.50 (Nomads) and 5.32 (permanent houses).

^{1/} The Item No. refers to the Item No. listed in the models, e.g. No. 3 refers to Item No. 3 in Table A8.5 (Livestock Income Sub-Model).

10. (7/8).

11. (7/9).

E. SUPPORTING NOTES FOR TABLE A8.6 (HUMAN CALORIE AND PROTEIN BALANCE
AND GROSS VALUE OF CROP AND LIVESTOCK PRODUCTION)

Item No. ^{1/}

- 1-2. Basic data from Holt, R., 1985. Agro-pastoralism and Desertification in Ceel Dheer district. Preliminary Investigation and Trial Results, CRDP Technical Report No. 3, 130p; and from Holt, R. (pers. comm.).
3. (1 x 2).
4. From Table A8.5 (Item 9).
5. (3 x 4).
6. Farm-gate prices.
7. (5 x 6).
8. (7/4).
9. Calorie value of sorghum - from Cooper et al, 1958. Nutrition in Health and Disease, Lippincott.
10. (5 x 9).
11. Same reference as for 9.
12. (5 x 11).
13. From Table A8.4.
14. (10-13).
15. From Table A8.4.
16. (12-15).
17. From Table A8.5.
18. Item 8.
19. (17 + 18).

^{1/} The Item No. refers to the Item No. listed in the models, e.g. No. 3 refers to Item No. 3 in Table A8.6 (Human Calorie and Protein Balance and Gross Value of Crop and Livestock Production).

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

TERMS OF REFERENCE FOR TECHNICAL ASSISTANCE

AND SENIOR STAFF

TERMS OF REFERENCE FOR TECHNICAL ASSISTANCE AND SENIOR STAFFTABLE OF CONTENTS

<u>Position</u>	<u>Page</u>
1. Project Manager (National Staff)	1
2. Head of Field Services (National Staff)	2
3. Chief Technical Manager (Expatriate)	2
4. Chief Extension Officer (Expatriate)	3
5. Livestock Production Officer (Expatriate)	4
6. Rangeland Manager (Expatriate)	5
7. Development Systems Analyst (Expatriate)	6
8. Rural Development Socio-Economist (Expatriate)	7
9. Head of Agro-Pastoral Section (Expatriate)	8
10. Master Mechanic (Expatriate)	10
11. Financial Manager (Expatriate)	10
12. Proposed Seed Multiplication Farm and Agro-Pastoral Adaptive Trials Site Selection and Site Design Study	12
13. Range and Livestock Association Study	17
14. Proposal For Agro-Pastoral Private Enclosure Study	19
15. Proposal For Agro-Pastoral Trial Study Tour	23

TERMS OF REFERENCE FOR TECHNICAL ASSISTANCE AND SENIOR STAFF1. Position: Project Manager (National Staff).

Duration of Assignment: 6 years.

Duty Station: Mogadishu, Somalia.

Language: English.

Qualifications: A degree in range management, natural resources management, livestock production or equivalent, preferably with under-graduate course in range management in Somalia.

Experience: At least 7 years working experience in range management, and arid forestry production in pastoral and agro-pastoral areas of Somalia. Considerable experience in the implementation of multi-component development projects by international donors. Proven experience in team management.

Duties and Responsibilities:

- (a) Responsible to the General Manager, National Range Agency, Ministry of Livestock, Forestry and Range.
- (b) Responsible for managing all components of the project. He would act on guidelines laid down by the Project Steering Committee (PSC) and be its Executive Secretary.
- (c) Strengthen a Project Management Unit (PMU) chaired by him, such committee would meet at weekly intervals.
- (d) Submit annual work plans and budgets to the PSC for review and approval.
- (e) Manage and ensure the expeditious implementation of work plans and budgets, approved in advance by the PSC, in collaboration with the PMU.
- (f) Manage and ensure, in accordance with the project agreement, the efficient utilisation of all project inputs including equipment, supplies, vehicles and facilities purchased for the purpose of the project, and be solely responsible for assigning and administering such inputs.
- (g) Manage and ensure the efficient utilisation of all staff employed under the project - in this context in consultation with the General Manager of NRA, he would be responsible for recommending the employment and dismissal of both national and international staff, the discipline of all staff employed under the project, and for recommending within permissible limits, incentive payments for outstanding staff performance.
- (h) Report on a regular basis as and when required, and in any event not less than quarterly, on the progress of overall project implementation, including recommendations for the project's modification and/or general improvement.
- (i) While the Project Manager would normally reside and work in Mogadishu, it is expected that he would spend a proportion of his time in the field.

- 177
- (j) Suggest ways to improve project performance and the need for changes in procedure.
 - (k) Co-ordinate implementation of all aspects of the project by working through the different Ministries concerned with the project and various donor agencies working in the central part of Somalia, thereby facilitating co-ordination between donors and maximising the efficient use of resources.

2. Position: Head of Field Services (National Staff).

Duration of Assignment: 6 years.

Duty Station: Mogadishu, Somalia.

Language: English.

Qualifications: Degree in range management, or similar.

Experience: At least 8 years working experience in range management, agro-pastoral development, agricultural extension, water management, and construction in tropical and arid areas.

Duties and Responsibilities:

- (a) Report to the Project Manager.
- (b) Responsible for construction activities of CRDP, for maintenance of roads, for dugout construction and for the operation of the bore maintenance team.
- (c) Responsible for providing support assistance to regional and district headquarters, including agro-pastoral development and the project's extension activities.
- (d) Prepare quarterly forecasts for the commodities and equipment required for the efficient maintenance of field services.
- (e) Working closely with the Technical Manager to achieve targets as planned under the annual work plan.

3. Position: Chief Technical Manager (Exp.).

Duration of Assignment: 6 years.

Duty Station: Mogadishu, Somalia, with regular field work in Central Somalia.

Language: English.

Qualifications: A degree in livestock production, agriculture, range management, natural resource management, or equivalent. Post-graduate qualifications in management, development studies, economics or sociology would be an advantage.

Experience: At least 10 years experience in tropical/sub-tropical pastoral and agro-pastoral production. Proven ability to technically manage a team. Ability to work in remote areas under difficult conditions necessary.

Duties and Responsibilities:

- (a) Responsible to the Project Manager.

- (b) Responsible for overall technical direction, co-ordination and supervision of all project technical activities which include: agro-forestry, livestock production and health, range management, soil and water conservation, water development, socio-economics/rural development, remote sensing/monitoring, and herbarium and documentation centre operation.
- (c) Maintain regular contact with the Project Manager, giving him technical advice and assistance as needed.
- (d) Take responsibility for ensuring an effective, efficient and timely project planning and reporting system (including resource and service needs and allocation) is established and maintained on a quarterly, six monthly and annual basis.
- (e) Responsible for preparation of annual work plans and physical budgets, and responsible for execution with assistance from all Technical Advisers and the Head of Field Services.
- (f) Responsible for technically managing the systems investigation and monitoring programme (SIMP) and ensuring that staff work together as a team to efficiently complete and document the study in a timely and efficient manner.
- (g) Assist and guide the Project Manager in formulating policies designed to improve the impact of CRDP-II.
- (h) Ensure the project establishes and fully utilises progress, impact, monitoring, evaluation and review procedures.
- (i) As Secretary, ensure the PMU meets weekly and performs efficiently and effectively.
- (j) Design, organise and co-ordinate a system to convey the objectives, goals, methods and results of the project to the inhabitants of Central Somalia and concerned local and international organisations and individuals.
- (k) Liaise and co-ordinate with other groups, organisations and Ministries concerned with developing Central Somalia, particularly USAID, GTZ, OXFAM and WFP, to facilitate co-ordination and efficient use of resources.

4. Position: Chief Extension Officer (Exp.).

Duration of Assignment: 6 years.

Duty Station: Mogadishu, Somalia, with considerable field work in Central Somalia.

Language: English.

Qualifications: Degree in agriculture, range management, natural resource management or animal production. Post-graduate qualifications in management, extension and sociology would be useful.

Experience: At least 8 years experience in management, extension and training in tropical/sub-tropical pastoral and agro-pastoral production.

Experience in implementing a T & V extension programme highly desirable. Ability to improvise, innovate and work as a team member in remote areas under difficult conditions required.

Duties and Responsibilities:

- (a) Responsible to the Head of Field Services.
- (b) Responsible for organising and consolidating the establishment of an effective project extension section.
- (c) Responsible for providing all extension staff with adequate technical direction, supervision and training.
- (d) Institute an appropriate extension system for pastoralists and agro-pastoralists based on the training and visit (T & V) system, amended as appropriate.
- (e) Keep the extension staff abreast of appropriate technical developments by maintaining regular communication with relevant international and local organisations.
- (f) Liaise with all other project components and technical experts.
- (g) Responsible for ensuring that the Extension Section produces a quarterly CRDP newsletter, weekly radio programme, video and slide educational films and other audiovisual aids in an efficient and timely manner.
- (h) Provide overall co-ordination and technical direction to the Extension Section's field activities, agro-pastoral training, rural development, and family and audiovisual/media activities.
- (i) Ensure the Section's regular plans and reports are closely co-ordinated with other components and produced in a timely manner.
- (j) Learn the Somali language to promote the maintenance of an adequate dialogue with the pastoralists and agro-pastoralists, and with local officials in Central Somalia.
- (k) Responsible for the design, organisation, co-ordination, and execution of an appropriate, timely and relevant in-service training programme, which fulfils the training needs of all staff.

5. Position: Livestock Production Officer (Exp.).

Duration of Assignment: 4 years.

Duty Station: Mogadishu, Somalia, with extensive field work in Central Somalia.

Language: English.

Qualifications: Degree in livestock production/husbandry, additional post-graduate training in agriculture, range management, economics, or similar relevant topics an advantage.

Experience: At least 5 years professional experience in tropical/sub-tropical pastoral livestock production. Experience with nomadic/semi-nomadic pastoral systems, rapid herd appraisal techniques, computers

and simple system modelling an advantage. Ability to improvise and work in remote areas under difficult conditions necessary.

Duties and Responsibilities:

- (a) Responsible to the Chief Technical Manager.
- (b) Responsible for designing, technically directing, supervising, and undertaking the livestock production/husbandry aspects of the pastoral production system studies (SIMP).
- (c) Work as an integrated team member with the project's agro-pastoral, extension, livestock, socio-economic, range management and system analyst staff to carry out the project's studies and interventions.
- (d) Train and work closely with the Senior Livestock Production Officer (Somali).
- (e) Under the co-ordination of the Technical Manager, regularly contribute to the training units' in-service staff training programme.
- (f) Responsible for producing a livestock production extension material, technical reports, a livestock production staff manual and CRDP newsletter contributions.
- (g) Identify and evaluate livestock production interventions to improve the sustainable productivity of the pastoral systems.
- (h) Evaluate the potential for making greater alternative use of livestock resources, including camel riding, camel transport and various animal traction uses.
- (i) Provide extension staff with training, technical direction and assistance to demonstrate and to transfer successfully evaluated technology.
- (j) Technically supervise and train SIMP and district staff to undertake the studies, interventions and monitoring.
- (k) Prepare 6 monthly and yearly component plans and reports in a timely manner.

6. Position: Rangeland Manager (Exp.).

Duration of Assignment: 5 years.

Duty Station: Mogadishu, Somalia, with extensive field work in Central Somalia.

Language: English.

Qualifications: Degree in range management. Post-graduate training in range, natural resources, soil and water conservation, or other relevant disciplines an advantage.

Experience: At least 5 years professional experience in tropical/sub-tropical rangeland management. Experience must include remote sensing, rapid extensive range survey and condition assessment techniques, range

131
monitoring, water development, and soil and water conservation and management. Ability to improvise and work in remote areas under difficult conditions necessary.

Duties and Responsibilities:

- (a) Responsible to the Chief Technical Manager.
- (b) Responsible for designing, technically directing, supervising and undertaking the range management, soil and water conservation and water development aspects of the project, including SIMP activities.
- (c) Work as an integrated team member with all the project components to undertake the studies and interventions planned as efficiently and effectively as possible.
- (d) Train and work closely with the Senior Range Manager (Somali).
- (e) Under the co-ordination of the Chief Technical Manager, regularly contribute to the in-service staff training programme.
- (f) Responsible for producing staff training manuals, extension material and CRDP newsletter articles on range management, soil and water conservation and water development.
- (g) Making extensive use of remote sensing, including systematic reconnaissance flights, complete range vegetation and condition surveys for all of Central Somalia. Integrate the results as a part of SIMP to complete practical range development plans for all traditional grazing areas (degaans).
- (h) Complete the establishment of simple, appropriate and sustainable range condition monitoring programmes for Central Somalia.
- (i) Technically supervise and train SIMP and district staff to undertake the studies, interventions and long-term monitoring in a timely and efficient manner.
- (j) Prepare 6 monthly and annual component plans and reports.

7. Position: Development Systems Analyst (Exp.).

Duration of Assignment: 4 years.

Duty Station: Mogadishu, Somalia, with field work in Central Somalia.

Language: English.

Qualifications: Bachelors and a Masters degree in range management or similar. Qualifications should include high level training in biostatistics and computer analysis. Training in remote sensing an advantage.

Experience: At least 5 years experience analysing livestock and agriculture production systems data. Extensive experience with remote sensing required. Experience with modelling pastoral/agro-pastoral production systems an advantage. Ability to improvise and work as a team member under remote and difficult conditions necessary.

Duties and Responsibilities:

- (a) Responsible to the Chief Technical Manager.
- (b) Responsible for undertaking and ensuring the technical information collected by all the project's studies and monitoring activities are collected, analysed, and documented in a timely, efficient and integrated manner, using the systems approach.
- (c) Train and work closely with the Senior Systems Analyst (Somali).
- (d) Establish, train and technically supervise the remote sensing and monitoring unit.
- (e) Develop the capacity of the remote sensing and monitoring unit so that by the end of the contract it is able to independently monitor Central Somalia's production systems.
- (f) Work with the SIMP unit providing remote sensing and analytical support.
- (g) Under the co-ordination of the Chief Technical Manager, regularly contribute to the in-service staff training programmes.
- (h) Develop an interactive information system covering the natural resource base, climate fluctuations, socio-economics and the project's activities which would be kept up-to-date through the monitoring programme.
- (i) Use the information system to develop input/output models of local households and production systems.
- (j) Analyse present production systems using the information collected by SIMP with a systems modelling approach so that cost/benefit analysis can be applied to planned and completed project interventions.
- (k) Monitor the performance of production systems following specific interventions and use the findings to guide fine adjustments or redesign the project's approaches and activities.
- (l) Liaise and co-ordinate with other organisations involved in remote sensing and environmental monitoring in Somalia to ensure that the project's activities fit into a national frame work.
- (m) Prepare a remote sensing and environmental monitoring technical training manual for local staff.
- (n) Prepare 6 monthly and annual component plans and reports.

8. Position: Rural Development Socio-Economist (Exp.).

Duration of Assignment: 4 years.

Duty Station: Mogadishu, with most of time on field duties in Central Somalia.

Language: English, with Somali and/or Arabic an advantage.

Qualifications: A degree in development anthropology/sociology. Additional training in economics, rural development and agriculture/pastoralism essential.

183
Experience: At least 8 years professional post-graduate work experience in social anthropology and economics. At least 2 years experience working with pastoral/agro-pastoral people in Africa highly desirable. Sensitivity and commitment to working as a team member to achieve project objectives in remote areas under difficult conditions a requirement.

Duties and Responsibilities:

- (a) Responsible to the Chief Technical Manager.
- (b) Responsible for working as a team member to undertake the anthropology, sociology, economic and land use aspects of the Systems Investigation and Monitoring Programme (SIMP) study.
- (c) Responsible for training his assistant and counterpart, the Senior Socio-Economist, and the Rural Development Section staff, and for contributing to the extension and general staff in-service training programmes.
- (d) In close consultation with the Chief Extension Officer and Senior Rural Development Officer (Somali), responsible for developing and instituting the policy and programme for forming and establishing range and livestock associations as effective pastoral/agro-pastoral community development organisations.
- (e) Devise, establish and train a project monitoring unit and establish a reporting methodology.
- (f) Learn the Somali language to help develop a good understanding of the local socio-economic system, and to maintain an effective dialogue with the target population.
- (g) Give the project's technical and managerial staff professional advice on how to develop and implement interventions so they would be socially acceptable, economically viable and sustainable under local conditions.
- (h) Give the extension staff, but particularly the Rural Development Group, advice and training regarding assistance with promotion and support of local pastoral/agro-pastoral rural development and income diversification initiatives.
- (i) Provide support for other organisations, including NGOs to work with the project's RLAs and other local groups to achieve the project's objectives.
- (j) Document all plans, technical results and reports as required by the Chief Technical Manager, in a timely and professional manner.
- (k) Assist the project to design, develop and institute policies which will improve the ability of local community groups, RLAs and private enterprise to develop the local pastoral/agro-pastoral economy and manage interventions.
- (l) Provide the format for the annual work plans.

9. Position: Head of Agro-Pastoral Section (Exp.).

Duration of Assignment: 6 years.

Duty Station: Mogadishu, Somalia, with much of time on field duties in Central Somalia.

Language: English.

Qualifications: A degree in agronomy required with appropriate post-graduate training desirable. Graduate/post-graduate training in agriculture, animal production and forestry/silviculture an advantage.

Experience: At least 8 years post-graduate experience required in rainfed, pasture and crop production under arid/semi-arid, tropical/sub-tropical conditions. Experience with integrated rainfed crop and livestock farming systems, soil conservation, agro-forestry, silviculture and trial design highly desirable. Ability to improvise, innovate and work effectively as a team member in remote areas under difficult conditions required.

Duties and Responsibilities:

- (a) Report to the Head of Field Services.
- (b) Technically direct and supervise all Agro-pastoral Section activities.
- (c) Design and implement a regular on-the-job training programme for the Agro-pastoral Section staff. This would include contributions to the regular monthly extension staff training programmes and local and external short courses.
- (d) Liaise at least once a year with all other organisations undertaking relevant research and adaptive trials in Somalia.
- (e) Make full use of appropriate research results from international organisations including ILCA, ICRISAT, ACIAR, ICARDA and ICRAF.
- (f) Design and implement simple, appropriate and practical agro-pastoral adaptive trials programmes using short-term Agronomic, Soil Science and Arid Land Forestry consultants as necessary.
- (g) Identify and test potentially valuable, indigenous and exotic plants.
- (h) Technically advise and supervise the Seed Multiplication and Storage Centre to ensure it produces sufficient quality seed in a timely manner.
- (i) Technically direct and supervise all project forestry/agro-forestry/silvicultural activities, including the establishment of nurseries, species elimination trials, fodder trials, shelterbelts and shade tree planting.
- (j) Develop practical and economic agro-pastoral interventions which would be adopted by local agro-pastoralists, and meet the project's objectives.
- (k) Technically direct and supervise the establishment of two agro-pastoral adaptive trials, and numerous on-farm trials and demonstrations.
- (l) Design and co-ordinate an effective agro-pastoral extension programme in conjunction with the Chief Extension Officer. This would be based on an adjusted T & V extension system and involve the rapid dissemination of agro-pastoral technology through education, technical advice and limited help to provide inputs.
- (m) Prepare Agro-pastoral Section extension material and regular Section plans, reports, budgets and technical publications.

(n) As a team member, undertake the agro-pastoral research aspects of the Systems Investigation and Monitoring Programme (SIMP).

(o) Devise schemes to encourage private planting of vegetation around villages.

10. Position: Master Mechanic (Exp.).

Duration of Assignment: 5 years.

Qualifications: Automobile Mechanic. Training in 4WD vehicles, medium sized trucks and auto-mechanics necessary.

Experience: Minimum of 6 years experience as professional Master Mechanic. Minimum of 3 years international experience.

Language: English, and Somali useful.

Duties and Responsibilities:

(a) Responsible to the Project Manager.

(b) Help design the extension of the central workshop, workshop reception and spare parts store.

(c) Plan and order spare parts in a timely manner for all project vehicles.

(d) Organise and supervise the storage and issuing of spare parts, and an up-to-date store stock card index system.

(e) Responsible for the proper care of all vehicles, ensuring they are serviced and repaired in an efficient and timely manner.

(f) Technically direct, supervise and co-ordinate all workshop staff paying particular attention to training the senior Somali mechanic.

11. Position: Financial Manager (Exp.).

Duration of Assignment: 6 years.

Duty Station: Mogadishu, Somalia.

Language: English.

Qualifications: Professional qualification in financial and cost accounting or equivalent post-graduate qualification.

Experience: At least 10 years experience in developing countries - preferably Africa. Extensive experience in financial management, cost accounting and administration.

Duties and Responsibilities:

(a) Responsible to the Project Manager.

(b) Control of finance, accounting and administrative aspects of project management.

(c) Ensure the timely preparation of monthly and annual accounts, cash flows and annual budgets.

- (d) Establish and co-ordinate the work of a cost recovery unit.
- (e) Ensure that funding is available for project operations.
- (f) Establishment and control of suitable procurement procedures.
- (g) Control of disbursement and withdrawal applications for all project components.
- (h) On-the-job training of local staff within the Finance and Administrative Division.
- (i) Maintain regular contact with the Project Manager, giving financial and administrative advice and assistance as needed.
- (j) Control of project personnel matters.
- (k) Control of store accounting and operation, and project inventory and assets.

12. Proposed Seed Multiplication Farm and Agro-Pastoral Adaptive Trials Site Selection and Site Design Study

Background/Introduction

Seed Multiplication. CRDP-II has a considerable seed requirement generated by the agro-pastoral, agro-forestry, forestry, and soil and water conservation activities. Much of the seed needs would be met by, whenever possible, contracting out production and local collection.

Initial stock would be imported. Subsequently, it would be multiplied by the project. CRDP-II would establish a seed multiplication unit near Bula Burti, the centre of Central Somalia's most productive agro-pastoral area. The seed multiplication unit would be provided with the necessary inputs to ensure the reliable production of good quality seeds. Under local conditions it would need to be irrigated and the site would therefore have to be chosen carefully.

CRDP-I has identified a potential seed multiplication area, close to the CRDP compound at Bula Burti district headquarters, on the edge of the Shebelle River. This 80 ha site, owned by the project, has a new project water bore equipped with a new diesel pump. The Shebelle area soils and the river water are, however, saline. The production and quality of the borehole needs to be clarified. Thus, a study would be needed to determine whether this site is suitable and, if not, to identify alternative sites. The production farm would be carefully designed to ensure efficient irrigation and drainage.

Adaptive Trials. The project would establish two main adaptive trial sites to test and evaluate potentially useful agro-pastoral technology under local conditions, before dissemination and distribution to local inhabitants. Most of this technology would require a few seasons of trial results before it can be promoted. The first trials were started in 1985 to test some potential agro-pastoral interventions at Nooleeye in Ceel Dheer district.

The project would establish another agro-pastoral adaptive trial site and two small field trials in the Shebelle clay agro-pastoral production system near Bula Burti. A few trials would be initiated at the main trial site in 1987.

A study would be necessary to locate suitable sites for the trials. Agronomic and soil factors would be carefully studied, in conjunction with consideration of the local land use, animal husbandry and social factors. If the adaptive trials are to be useful, they must be located at representative sites.

Species Elimination/Growth Trials. The second phase would expand arid land forestry activities. Appropriate tree and bush species would be required for many project activities including agro-forestry, agro-pastoralism, community village tree planting, shelterbelts, sand dune fixation and high watertable agro-forestry trials. Suitable species would need to be selected for a number of representative eco-systems.

Some knowledge was gained during the first phase. This was limited mainly to the three regional headquarters where most of the GTZ forestry component's work was located. Central Somalia is semi-arid to very arid, so the task of selecting adapted species would not be easy. Further, it is usually only economically possible to establish tree or bushes under rainfed conditions, or with limited initial watering. Some suitable species have been identified, but other potential species remain to be tested.

188

As so many CRDP-II activities depend on the identification of suitable species, and a few seasons of results are needed before recommendations can be promoted, these trials sites would be located as early as possible. The sites would be carefully chosen to be representative, with soil, climate, cropping history, topography, hydrology, social and local land use factors taken into account. One trial has already been initiated near Hobbio township. A further five trials are planned to be established in 1987 and 1988. The design of these trials is being co-ordinated with a nation-wide programme under consideration by ODA. CRDP-II would be responsible for the Central Somali area, and would share its results.

High Watertable Agro-Forestry Trials. Some limited areas of Central Somalia have high watertables. The potential of these for small areas of more intensive alternative land use would be evaluated. Production in the project area is dependent on a few months of seasonal plant growth each year. Most tree and bush species are deciduous, so livestock suffer nutritional stress in the dry seasons. Evergreen fodder trees and bushes from similar arid areas in Australia and the Americas may have potential to provide fodder for high value uses, such as port or saleyard holding grounds, or village dairies. The local value for such fodder is high and private groups have shown interest in establishing fodder production units. Examples of arid land livestock industries based on high quality fodder production include the recently developed sheep industry in Chile, which is dependent on the introduction of Prosopis tamuargo in saline high watertable areas, and the livestock industries based on introduced spineless cactus in north and southern Africa.

Some high watertable areas may be able to support some limited, local fruit and vegetable growing. Dates have been successfully grown on the Heredhaley high watertable area west of Hobbio. Coconuts and cashew nuts are grown on the treeless coastal plain at Adadle, just south of the project area, under very similar conditions to those which exist along the 800 km coastal plain in the project area. At this same site, Casuarina trees have grown excellently, providing an effective windbreak and a potential wood source. In far western Hiran region, tomatoes are sometimes grown in high watertable areas.

Proposals to make use of any high watertable site would be carefully evaluated. Usually, humans and livestock are already using some of this water for their direct needs. In designing and locating the trials, the needs and land use of the local people would be taken into account, and an appropriate agro-forestry system designed. The local soil, water quality (and quantity), climate, land use history, and topography would all be considered. An expert would examine the potential sites and evaluate and plan proposals. To assist CRDP-II planning this would be done as soon as possible. Also, as agro-forestry trials are long-term in nature, the trials would be established early in the project.

Objectives

- (a) To undertake the site selection and site design work for: the proposed seed multiplication unit; agro-pastoral adaptive trials; species elimination and growth trials; and the high watertable agro-forestry trials.
- (b) To complete the studies as quickly and as soon as possible in 1987.

Methodology

- (a) General. The studies would be combined into one study and undertaken in a phased manner by a small, highly competent team. The team would

consist of an experienced Agronomist (Team Leader), and a Soil Scientist. The Team Leader would be employed for 3 months and the Soil Scientist for 2 months. They would be supported by an Arid Land Forester and a Hydrological Engineer (Somalis) for a month. Somali consultants would be contracted to the firm undertaking the study. The project's ecology and extension staff would provide local knowledge and contact with the local inhabitants.

- (b) Preparation. The consultants would be expected to conduct an initial search of the literature to make use of any knowledge available on local soils, climate, water quantity and quality, and suitable tree and bush species. Local consultants would be located and hired to support the study team, and to help develop the local professional capacity.
- (c) Field Study. The study Team Leader and the Soil Scientist would visit and inspect all the proposed trial sites with the project's Chief Extension Officer and Rangeland Manager. The project would provide the team with in-country transport. The field work would be phased so that the Arid Land Forester could accompany the team to inspect the proposed sites for the adaptive trials, species elimination trials, and agro-forestry trial. The input by the Hydrological Engineer would be phased to investigate the seed multiplication farm site and the high watertable trial sites.

The team would hire local workers, in addition to consultant assistance, to help dig soil profiles and take soil and water samples. A small engine-driven pump would be hired locally to evaluate the water supply and quality.

The team would be provided with equipment and supplies to do as many soil and water tests as possible whilst in the field. Some soil and water samples would be sent abroad for more intensive and accurate analysis. If it proves possible, some analysis would be contracted out locally.

- (d) Report. An outline report would be presented and discussed with the project before the team leaves Somalia. The Team Leader would have one month abroad after the surveys to obtain the soil and water analyses, complete drafting work, complete the final copy of the report, and have 50 copies sent to the Project Manager.

Position: Agronomist/Team Leader.

Duration of Assignment: 3 months.

Duty Station: 2 months based in Mogadishu, Somalia, with much of the time in the project area. One month in home office.

Language: English.

Qualifications: A degree in agronomy and agriculture. Appropriate post-graduate qualification desirable.

Experience: At least 10 years experience in tropical, sub-tropical and arid land agronomy. Professional experience in designing flood irrigation systems a necessity. Managerial and team work experience highly desirable. Experience in working in remote areas under difficult conditions required.

190

Duties and Responsibilities:

- (a) Report directly to the Project Manager, CRDP.
- (b) As Team Leader, responsible for organising, planning, directing and co-ordinating all aspects of the study.
- (c) Locate appropriate, available and representative sites for trials:-
 - 20 ha irrigated seed multiplication farm,
 - two, 40 ha adaptive trial sites and two, 10 ha field adaptive trials,
 - six plant species elimination and growth trial sites, and
 - three to six high watertable agro-forestry trial sites.
- (d) As Team Leader, ensure all sites chosen are representative and suitable with respect to soils, climate, cropping history, topography, hydrology, availability, and land use.
- (e) Provide the detailed design of a simple, effective flood irrigation scheme for the seed multiplication farm, including complete specifications and requirements for the pumping and water distribution and drainage systems.
- (f) Liaise closely with project staff, particularly the local District Range Officer, and the Chief Extension Officer.
- (g) Present and discuss an outline report with project management before leaving Somalia.
- (h) Present 50 copies of the final report to the Project Manager no later than 4 months after contract commencement.

Position: Soil Scientist.

Duration of Assignment: 2 months.

Duty Station: Based in Mogadishu, Somalia, but most of time in Central Somalia.

Language: English.

Qualifications: A degree in soil science with post-graduate training desirable.

Experience: At least 8 years professional experience as a practising Soil Scientist. Experience necessary in undertaking soil surveys and field analysis and characterisation of soil in remote areas under difficult conditions. Experience with salinity problems in soils an advantage. Some arid land and tropical soils experience required.

Duties and Responsibilities:

- (a) Report to study Team Leader.
- (b) Responsible for undertaking a soil survey of the localities where the trial sites are proposed, to ensure the sites are representative and suitable for the trials.
- (c) Undertake some on-the-spot chemical and physical field soil analyses.

- 191
- (d) Organise more comprehensive laboratory analyses of trial site soils to check on soil nutrient status. Provide explanations and agronomic recommendations for CRDP trials to Agro-Pastoral Officers, based on the results.
 - (e) Organise and direct the activities of the local staff employed to assist with the soil surveys and analyses.

Position: Arid Land Forestry.

Duration of Assignment: 1 month.

Duty Station: Based in Mogadishu, Somalia, but most of the time on field work in Central Somalia.

Language: English.

Qualifications: A degree in forestry/silviculture with additional training in agro-forestry and arid land forestry desirable.

Experience: At least 5 years professional forestry/silviculture experience working in arid and semi-arid areas. Extensive knowledge of available multi-purpose tree and bush species for such areas a necessity. Proven ability to work effectively as a team member in remote areas under difficult conditions would be an advantage.

Duties and Responsibilities:

- (a) Report to the study Team Leader.
- (b) Responsible for recommending appropriate tree and bush species/varieties for the main eco-systems in Central Somalia. The species should include both local and well-proven international varieties.

Recommendations should be given for:-

- (i) live hedge fencing species,
- (ii) multi-purpose intercrop agro-pastoral species,
- (iii) alley cropping species,
- (iv) dry season fodder production species,
- (v) windbreak and shelterbelt species,
- (vi) high watertable multi-purpose species, and
- (vii) village shelter and fruit trees.

All species and varieties recommended should have a high probability of growing under rainfed conditions (except perhaps (vii)). Recommended varieties should also be listed in order of priority for each of the trial sites located by the study team.

- (c) List the sources and methods of procuring all the species recommended.
- (d) Work as a team member with the study group to help select sites, and formulate site designs.
- (e) Liaise closely with CRDP staff, particularly the Forestry, Soil and Water, and Agro-Pastoral Groups.

Position: Hydrological Engineer.

Duration of Assignment: 1 month.

Duty Station: Based in Mogadishu, Somalia, but most of time on field work in Central Somalia.

Language: English.

Qualifications: A degree in hydrology, with appropriate post-graduate qualifications an advantage.

Experience: At least 5 years professional experience as a Hydrologist. Extensive experience with groundwater supplies necessary, including quality, quantity, testing, mapping and use. Proven ability to work effectively as a team member in remote areas under difficult conditions would be an advantage.

Duties and Responsibilities:

- (a) Report to the study Team Leader.
- (b) Responsible for testing the quality and quantity of water sources for the seed multiplication farm's irrigation needs. Assist the Team Leader to design the irrigation system.
- (c) Responsible for testing the quality and quantity of groundwater at the potential high watertable agro-forestry trial sites. Test the draw down and recharge characteristics and advise on sustainable surplus water availability for agro-forestry, allowing for existing and projected local land use needs.
- (d) Liaise with the Water Development Agency and CRDP staff.

13. Range and Livestock Association Study

Background/Introduction

CRDP-II would form additional RLAs and funnel most development proposals through them. RLAs would have a crucial role in the future development of Central Somalia. They would be developed as representative community organisations able to communicate effectively with other organisations, and capable of obtaining contributions and the participation of the community in local development activities. They would become increasingly responsible for managing and maintaining developments in their areas.

RLAs are, however, still at an embryonic stage of development. To-date, they have been mainly involved in helping CRDP ensure that deferred grazing reserves are properly managed. CRDP-II design recognises that RLAs would require considerably greater support and training if their role and capacity was to be significantly increased.

Before CRDP-II commenced, it would be essential to have an independent analysis and review of the current status of RLAs, with recommendations as to how they could be best organised and supported. A number of important issues would be addressed. CRDP has chosen the users of a traditional grazing area (degaan), which is based on a major permanent watering point, as the membership unit of an RLA. There are 6-13 degaans per district and thus 80-110 potential RLAs in Central Somalia. Smaller units may be more effective, but may be difficult to organise and support. Such matters should be considered before the project commences.

The legal and administrative status of RLAs also needs clarification. CRDP-II proposes to encourage local communities, through RLAs, to

contribute to local rural development and management. Whether RLAs are legally able to collect contributions to undertake such development work needs to be established and, if not, legislation proposed.

Objectives

- (a) Provide CRDP-II with an independent expert analysis of the potential of Central Somalia's RLAs and other community organisations for the basis of development.
- (b) Provide detailed recommendations, within the context of CRDP-II, on how RLAs or equivalent pastoral community groups could be formed (or used), organised and supported to ensure their effectiveness.
- (c) Ensure that an adequate legal and administrative framework for RLAs is planned and provided for CRDP-II.

Methodology

- (a) Preparation. The Anthropologist would provide a concise, professional, state-of-the-art review of the progress and results of forming nomadic/semi-nomadic, pastoral/agro-pastoral organisational frameworks for development, particularly with reference to Africa. This report would be included in the final report. The consultant would seek out and employ at least one (consultant) Somali Anthropologist/ Sociologist to assist his work, and together they would liaise with the project's extension staff and review the project's literature on RLAs, and their legal and administrative position.
- (b) Field Study. The Anthropologist and his associate would undertake an extensive field study, in conjunction with the project's extension staff. They would visit all existing RLAs and hold discussions with RLA Committees, local pastoralists and party officials. They would investigate the local pastoral organisational and decision-making structure by interviewing elders and observing and holding discussions with sample households.
- (c) Report. On the completion of the field study, a draft report would be presented and discussed with project management. Fifty copies of the final report would be presented to the Project Manager at the end of the contract period.

Position: Pastoral Development Anthropologist/Sociologist.

Duration of Assignment: 2 months.

Duty Station: Based in Mogadishu, with extensive field studies.

Language: English, with understanding of Somali an advantage.

Qualifications: A degree in anthropology, with additional training in sociology. Development studies are desirable but not required.

Experience: Extensive experience required in establishing pastoral organisational frameworks for development in Africa. Candidates would have had at least 5 years experience in tropical pastoral/agricultural development and have worked extensively with nomadic pastoral people. Experience with Somalis an advantage.

194

Duties and Responsibilities:

- (a) Report to the Head of the Extension Section within CRDP.
- (b) Investigate and review the existing and proposed strategies for forming and developing RLAs.
- (c) Recommend strategies, activities and support measures which CRDP-II could adopt to ensure RLAs become effective local representative community organisations for development.
- (d) Recommend practical methods for RLAs to become self-supporting with a capacity to manage and undertake local rural development.
- (e) Investigate the legal and administrative position of RLAs and recommend any changes necessary.
- (f) Work closely with the extension staff, particularly the Head of the Rural Development Group.

14. Proposal For Agro-Pastoral Private Enclosure Study

Background/Introduction

CRDP-II would reduce environmental degradation caused by shifting cultivation, in conjunction with increasing the sustainable productivity of the agro-pastoral systems. The significance of the agro-pastoral systems became increasingly apparent during the course of CRDP-I. It is more widespread than initially thought, and according to the local inhabitants, is increasing. In Ceel Dheer, extension surveys found that about 70% of the district's pastoralists were actually agro-pastoralists, combining both crop and livestock production.

Typically, pastoralists fence (enclose) areas of rangelands by using a fence of thornbush branches. The enclosure is then traditionally considered their property. There are two main types of enclosure: those used for cultivating crops or which are part of an agro-pastoral complex unit (a portion of which is being farmed); and those fenced just to provide private pasture and fodder. The latter, although less common, are increasing in density and perhaps size. They are larger, often 20-100 ha in size, and are often situated in rangeland areas unsuited to cultivation, such as Northern Ceel Buur and Dusa Mareb districts. The private enclosure of large areas of rangelands is locally controversial, while the cultivation of small enclosures is generally accepted. At present, the legal status of the enclosures is not completely clear (Holt, 1985). The Government and the project require further information to assist in formulating a policy towards land use and the enclosure phenomenon. They need to understand the rationale for the enclosures, and to determine their extent, as well as the importance of agro-pastoralism to the local economy.

Objectives

- (a) Determine the rationale for the establishment of the various types of enclosures in Central Somalia.
- (b) Determine the legitimacy of enclosures in relation to Somali Law, the District Governments, and agro-pastoral and pastoral producers, and advise on future policies.

- 195
- (c) Establish the history and current status of enclosures and agro-pastoralism in Central Somalia, and advise on the probable future trend.
 - ✓(d) Quantify and establish the trend in area of land farmed, enclosed and at various stages of fallow in a study area comprising Ceel Dheer and Southern Ceel Buur districts. Emphasis to be on development of techniques for CRDP-II to use.
 - (e) Determine the role and importance of agro-pastoralism in the local economy.
 - (f) Develop remote sensing and other sustainable investigative techniques needed for CRDP-II, and train project staff to use them. In particular, this would include the use of aerial photography, systematic aerial reconnaissance flights, and satellite imagery.
 - (g) Obtain aerial photographs and satellite images of the project area and the equipment needed to use them, so they are available for immediate use by staff at the commencement of CRDP-II.
 - (h) An important aim of this investigation would be to determine the extent to which CRDP-II and the Government can, and should, regulate the various aspects of a probably spontaneous movement and enlargement of enclosures. If interventions are appropriate, these would be investigated, and the recommendations documented.

Methodology. A firm would be contracted to supply the consultants, aerial photographs, satellite images and other resources necessary for the study.

Remote Sensing. The firm would provide the project with:-

- (a) A copy of aerial photographs and aerial photograph mosaics (taken in the early 1960s) for all the project area.
- (b) A copy of aerial photographs and aerial photograph mosaics of the area of Hiran region photographed in the early 1980s.
- (c) A copy of the latest high quality enhanced LANDSAT satellite images for all the project area.
- (d) Stereoscopes, planimeters, pantographs, a computer, photocopy machine and other associated equipment and supplies to establish a remote sensing unit.

Included in the contract would be 10 hours of flying time for observation and reconnaissance flights to assist the investigation.

Remote sensing would be used to enable the extensive study to be undertaken rapidly, for it to quantify the factors being measured, and to establish trends. The project has aerial photographs of Ceel Dheer and Southern Ceel Buur districts taken in 1986 and LANDSAT satellite images of the project area from the late 1970s. These would be available for the study personnel to use.

Field Research. The aerial photographs, satellite images and reconnaissance flights must be supported by field ground truthing, investigations and surveys to achieve the study objectives.

196

- (a) Considerable ground truthing would be needed to establish, map, and quantify the trend in areas of land farmed, enclosed, and at various stages of fallow. Examples of possible classes are: recently farmed (1-2 years), primary successional stage (2-6 years), secondary stage (6-20 years) and tertiary (beyond 20 years). The team's Geographer/Land Use Expert would be assisted by the project's Rangeland Manager. This investigation would include the history of different patterns of land use, and the causes of these patterns, including water development, soils and climate. The team's Anthropologist/Socio-Economist and the project's extension staff would help with this aspect of the study by building on existing information.
- (b) The team would determine the rationale for enclosures and their history of development, mainly by interviewing a socio-economic cross-section of local agro-pastoralists and pastoralists. Case studies on the history of movements and enclosures built by a family and its forebears, and the reasons for these, would be used to help the investigation. The project's extension staff would identify and work with local elders and sheiks well known for their local historical knowledge and reliability.
- (c) The team would undertake a number of on-site case studies of the various types of agro-pastoral and pastoral enclosure systems. They would measure the area of the enclosures and of farmed land, measure crop yields, count the number of livestock owned and grazed by herders, and complete a household socio-economic survey. The latter studies would include studies of the family, diet and income, with particular regard to the contribution of enclosures to the household economy.

Case studies would also investigate the ways in which herd owners use and manage crop residues and enclosed pastures. The studies would document the role of enclosures in animal husbandry, how, for example, some pastoralists use enclosures as paddocks to fatten livestock for sale or keep young sheep and goats. The team would be assisted with these investigations by the project's Chief Extension Officer and animal husbandry staff.

While undertaking the case studies, local staff working with the team would investigate existing and traditional methods of obtaining title to enclosures.

Consultation. The research team would fully discuss the issues under investigation at the beginning of the study with local Government and Party Officials, local elders, CRDP staff and other concerned parties, to seek their views. At the end of the study, before writing the report, they would discuss their findings with the same parties.

Report/Seminar. The final report would present the results of all aspects of the investigation, with specific recommendations for CRDP-II and GOS to adopt. To assist with the dissemination and discussion of the results, the team would present a one-day seminar in Mogadishu at the end of the study, with assistance from the project's Extension Section.

Responsibility/Staffing. The Team Leader would report directly to the Project Manager. He would at all times work in close consultation with the project's Chief Extension Officer and Ceel Dheer staff. Prior to working in any district, he would fully brief the local District Range Officer on the proposed activities in that district.

The project would supply at least four graduate staff to work with the team. They would assist the team and obtain on-the-job training. The consultants would hire up to four other local staff to help with their study.

Agro-Pastoral Private Enclosure Study - Training

Background/Introduction

It has been recommended by ILCA that, as data provided by systematic reconnaissance flights would be so important to the success of the Systems Investigation and Monitoring Programme (SIMP), and because this approach has long-term applicability to remote sensing programmes, CRDP-II should train its own staff to carry out the work. The only exception would be that the plane and pilot would be provided under contract.

Training of personnel would be carried out as soon as possible so that the first SRRF can be completed and trends determined by comparison with the last resource inventory in 1979. This information would provide an invaluable baseline for immediate use by the SIMP team in the first year of CRDP-II.

Two types of training would be required:-

- (a) air crew, and
- (b) data analysis support personnel.

The air crew would comprise five Somali staff, who would require training, plus a pilot who would be obtained under contract. The positions requiring training would be: four aerial observers/photo interpreters and one flight monitor. These staff would receive two weeks training in Nairobi where they would be exposed to the concept, equipment and methods used in systematic reconnaissance flights. This training would consist of visits to the various organisations involved in SRF activities. These include ILCA, UNEP (GEMS), KREMU, and a private company responsible for carrying out the training programme.

The remainder of the training would take two months, be the responsibility of a private contractor, be carried out within Somalia, and would include:-

- (a) Census design and operations.
- (b) Livestock counts and analysis (30 hours).
- (c) Vertical sample photography.
- (d) Analysis of sample photography.
- (e) Computer entry and validation of data.

Two positions are for data analysis support personnel; a data analyst and a computer operator. Training would be the responsibility of a private contractor, probably in Nairobi, would take two months, and would include:-

- (a) Introduction to micro-computing.
- (b) Use of geographic information software.
- (c) Input and validation of census data.
- (d) Integration with ancillary sources, e.g. land form, climate, soils, population.
- (e) Analysis, reporting, mapping of integrated survey data base.
- (f) Integration of monitoring data.

Prior to training commencing, the project would provide a dark room capable of developing and printing black and white photos (35 mm and 9 x 9 inch), a functioning computer system, and staff.

A light, high wing aircraft and pilot would be provided on an annual contractual basis to carry out SRF flights. The contract would provide pilot, plane, necessary navigational equipment, fuel, maintenance, as well as arrange all necessary official approvals for work in Somalia.

15. Proposal For Agro-Pastoral Trial Study Tour

Background/Introduction

The recent (August, 1986) World Bank supervision mission of CRDP-I recommended that the project consider a study tour for staff to examine agro-pastoral trials, agro-forestry techniques, animal traction uses, and other topics which would be major activities in CRDP-II.

Proposal. A staff study tour of selected activities in Kenya and Nigeria would be arranged. This would lead up to participation in a two-week course (April 13-24, 1987) in agro-forestry, alley cropping and agro-pastoralism, to be held in Nigeria under the sponsorship of ILCA and IITA (International Institute of Tropical Agriculture).

Justification. Although it is proposed that CRDP-II would contain agro-pastoral and agro-forestry activities, project staff have no formal training in these disciplines, as none is available in Somalia. However, in Kenya and Nigeria, relevant trials have been underway for many years. The staff would learn much from examining these trials, obtaining reference material and making contacts. The alley cropping course in Nigeria is relevant to project agro-pastoral work.

Proposed Participants. Five senior Somali staff, all with degrees (preferably in agriculture or closely-related fields) who would be working on agro-pastoralism in CRDP-II. They would be accompanied by an expatriate study Team Leader from the project, who would organise and co-ordinate the tour. He would not attend the two-week training course at the end of the tour.

Brief Proposed Study Tour Programme

A brief summary of a proposed tour is given below:-

29th March	:	Travel from Mogadishu to Nairobi.
30th March	:	Visit agro-forestry/agro-pastoral trials.
1st April	:	ICRAF (International Centre for Agro-Forestry Research) and ACIAR (Australian Council for International Agricultural Research) near Nairobi.
2nd April	:	Visit Kenya Range Ecological Monitoring Unit, Nairobi.
2nd-3rd April	:	Visit Rural Development Project, Baringo.
4th-5th April	:	Fly from Kenya to Nigeria.
6th-12th April	:	Study trip to North Nigeria, to be organised for CRDP by ILCA. Visit ILCA's arid land agro-forestry and agro-pastoral trials, study Fulani agro-pastoral system.
13th-24th April	:	Attend IITA, ILCA course in Ibadan, Nigeria, on Alley Cropping/Alley Farming.
25th-26th April	:	Fly back to Mogadishu.

CENTRAL RANGELANDS DEVELOPMENT PROJECT

PHASE II

PROJECT FILE REFERENCES AND BIBLIOGRAPHY

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