



FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS



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EMASAR PHASE II

Volume VII

NEAR EAST

GRASSLAND EDUCATION AND TRAINING

*With special reference to Iraq, Kuwait,
Somalia, Sudan, Syria, Yemen, P.D.R.*

AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

ECOLOGICAL MANAGEMENT OF ARID AND SEMI-ARID RANGELANDS

OF AFRICA, THE NEAR AND MIDDLE EAST

(EMASAR - Phase II)

Volume VII

NEAR EAST

GRASSLAND EDUCATION AND TRAINING

with special reference to Iraq, Kuwait, Somalia, Sudan, Syria, Yemen, P.D.R.

by

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Prepared as part of a cooperative project of the United Nations Environment Programme with the Food and Agriculture Organization of the United Nations as cooperating agency.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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1. INTRODUCTION

The EMASAR and its objectives

The EMASAR Conference held in Rome on 3-8 February 1975 underlined the serious deterioration of grassland conditions in Africa and the Near East and the Middle East. This valuable feed resource which covers about 94 % of the regions concerned, supports nearly 500 million head of livestock and produces about 2.5 million tons of meat in addition to valuable amounts of milk, wool and hides. In spite of the substantial contribution of grasslands to the national economy, they have to-date received relatively little attention. The Conference came to the final conclusion that arid and semi-arid grasslands deserve higher priority and emphasis in national, regional and international development and management programmes. As one of the main constraints for the implementation of grassland development in the EMASAR countries is the inadequacy of national technicians and trained manpower, great emphasis has been stressed on the urgent need of action relative to training and education at all levels on national and regional basis.

The present volume is part of the second phase of the EMASAR programme which has as objectives :

- to review the grassland education and information situation, in the several regions concerned, and make appropriate recommendations ;

- to prepare the establishment of a forage plant breeding and improvement programme for arid and semi-arid zones ;

- to assist the countries in the formulation of grazing land development projects and guidelines.

Vol. I (Pastoral development and extension work) and Vol. II (Grassland education and training) have dealt with the Sahelian countries.

Vol. III has synthesized the information concerning the most valuable forage plants indigenous in dry tropical Africa, as a preliminary to a breeding programme.

Vol. IV has done the same for some important forage plants of North Africa, the Near and the Middle East.

Vol. V has examined the grassland education and training situation in some countries of North Africa, the Near and the Middle East.

Vol. VI has done likewise for the Middle East.

Vol.VIII gives an account of a project formulation mission in Sudan and of relevant grassland development proposals.

Terms of reference of the mission

In compliance with the objectives of the EMASAR phase II project, the FAO allocated a one-man mission comprising Mr. A.W.A. El Moursi, Pasture and Fodder Development Officer, ECWA/FAO Joint Agricultural Division to visit Sudan, Somalia, PDRY, Syria, Iraq and Kuwait during the period 29 November-23 December 1977.

The terms of reference of the mission were to :

- Analyse the present situation in education, training and extension at different levels, in the field of pastureland and forage/feed production.
- Obtain details of training curricula being currently used and consider possible ways in which these might be improved.
- Review present and intended training and information programmes and procedures which would foster the participation of pastoral people and livestock owners in the development process and to propose improvements where these may be appropriate.
- Consider the availability of Near East orientated handbooks and syllabi for education and training in forage and feed matters, and propose improvements thereon.
- Translate the above proposals into a comprehensive paper on an education, training and information strategy for the region and into different country projects or programmes as appropriate.

Acknowledgement

The mission would like to express its gratitude and sincere appreciation for the assistance received from the six countries visited.

2. SUMMARY OF FINDINGS AND RECOMMENDATIONS

2.1. SUMMARY OF FINDINGS

2.1.1 Education

One of the major constraints hampering the proper utilization, development and improvement of grassland in the six countries visited (Syria excepted) is the acute shortage of trained and experienced personnel. The greatest need in these countries is for manpower capable of mobilizing the technical knowledge available in grassland management and synthesizing this knowledge in such a manner that it can be used to solve the national grassland problems. Some of the countries visited have none (PDRY and Kuwait) or very limited personnel trained in grassland problems and practically few of them

are able to apply their experience in an adequate manner due to poor facilities and incentives. In the Sudan, the number of personnel actively working in grassland are 24 professionals and 26 technicians (Table 1). In Iraq there are only 3 professionals and 10 technicians and in Somalia 1 and 20 respectively. Syria only has enough manpower to carry out actively plans for grassland improvement and development.

It is estimated that to achieve satisfactory results in grassland management, there should be one professional for every 10,000 square miles of grassland and one technician for every 4,000 square miles. Accordingly, Table 1 indicates the required number of personnel needed to reach the target for grassland improvement.

Table 1

Number of present and required professionals trained in grassland management in the six countries visited

Country	at present		required	
	Professionals	Technicians	Professionals	Technicians
Iraq	3	10	15	50
Kuwait	nil	nil	2	7
Somalia	1	20	50	160
Sudan	24	26	60	200
Syria	20	60	16	50

Table 2

Education Institutes or University and Intermediate levels having grassland management in their curricula

at University level	at Intermediate level
<u>IRAQ</u> Faculty of Agriculture and Forestry, University of Mosul	<u>SOMALIA</u> Range Management Institute, Burao
<u>SYRIA</u> Faculty of Agriculture, Damascus University Faculty of Agriculture, Aleppo University Faculty of Agriculture, Teshrine University	<u>SUDAN</u> Kuku Veterinary and Animal Husbandry Institute for Animal Health & Production Assistants
	<u>SYRIA</u> Arab Institute of Forestry & Rangelands, Lattakia Agricultural Secondary Schools (6)

(a) University level education in grassland management

Grassland management is not taught at all in most of the Universities of the six countries visited. It is not included, or not adequately so, in the curricula of Sudan, PDRY, Kuwait and Somalia.

In Iraq, the Faculty of Agriculture and Forestry, Mosul University, is the only Faculty out of four, to teach grassland management as a regular subject. Syria is giving this subject full consideration which is taught at all three Universities of Damascus, Aleppo and Teshrine.

(b) Intermediate level

At intermediate level, grassland management is not included in the syllabi of the intermediate colleges and institutes of Iraq, Kuwait and PDRY.

In Sudan, the Kuku Institute, and in Somalia the Range Management Institute, Burao, teach grassland management to students. The major constraint here are the lack of trained staff and the fact that the courses are too crowded and theoretical. They are merely a translation of syllabi introduced from foreign institutes and they do not fit local conditions.

Syria is aware of the need to teach grassland management at intermediate level in order to produce technicians capable of coordinating effectively with professionals in implementing development projects. The Arab Institute of Forestry and Rangeland, Lattakia, Syria, is the only intermediate institution in the Arab World having all the facilities to produce well trained and qualified technicians in this field. Grassland management is also taught at the six lower intermediate agricultural schools which exist in the country.

2.1.2 Extension

Grassland management, development and improvement programmes are generally not properly understood by pastoralists involved in the use of grasslands. Without a complete change in the present situation, very little can be expected from all the actions carried out by governments and international assistance. In the six countries visited, extension officers, if available, have usually been trained in some aspects of general agriculture with little, if any, specific knowledge of grassland management and fodder production, which they expect to pick up during their employment. Most of them are more concerned with the problems of crop production than with grassland problems.

Extension will have to be used to educate the pastoralists and livestock owners to bring about a balance between animal numbers and available forage supplies, good grassland management and adequate year long plans of nutrition. Farmers and livestock owners need much help in the form of demonstration and education programmes to encourage them to practise better livestock husbandry and better grassland management.

The extension services are not dealing much with the pastoral populations due to the shortage of staff and lack of budget and transportation facilities. However, all the governments realized that without the fullest cooperation from the pastoralists, the administrators and technicians can do little toward implementing effective management and improvement of the grassland resources.

Accordingly, Sudan is considering the implementation of cooperative ranches. In Somalia the National Range Agency in addition to its extension services, establishes Grazing Elder Association and Grazing Associations. In PDRY technical and social assistance are being given to the Bedouin populations in different parts of the country.

In Iraq, the extension services are dealing mostly with crop production and protection activities.

Syria with the assistance of WFP and FAO is considered a leader in this field with extension being carried out through the Bedouin School and Training Centre at Hama, the Range Cooperatives for the development of the Hema system, Range and Sheep Production Centres and Sheep Fattening Cooperatives.

2.1.3 Research and its relation with education

There is an acute shortage of information about the suitability of various grassland improvement and management practices under local conditions. Methods and techniques developed in foreign countries may or may not be applicable to the six countries visited. This indicates the importance of grassland research to evolve methods and techniques capable to ensure optimum production from the grazing lands. Without a well planned and organized research programme, grassland management will not make the desired progress.

To set up a well planned research programme adjusted to the needs of the country and to the national grassland development schemes, a close cooperation must be established between the educational institutions and the government research organizations.

Unfortunately this relationship, at present, is generally weak. In Sudan, Syria and Somalia there is little cooperation between research and extension. In Iraq coordination is good but at personal level. In Kuwait extension staff meets periodically with the research specialists to collect information for transfer to farmers. More coordination is practised in PDRY where government research staff is involved part-time with extension activities and assist extensionists in establishing field trials and demonstration in the various parts of the country.

Aside from the general lack of formal coordination, there are other problems which face the grassland research workers at the universities and research institutions. These problems are :

1. The excessive teaching load imposed by high students enrollments coupled with shortage of teaching staff ; there is consequently no time left for research.
2. Lack of advanced planning makes research workers undertake problems which have no relation with the country grassland problems and as a result the orientation for research is directed away from the national needs.
3. Salaries are low and the scales are tied to civil service regulations.
4. Promotion is ruled by civil service regulation where seniority has precedence over merit.
5. The lack of facilities discourage the research workers ; land and livestock resources are insufficient to carry out research.

In general, grassland management has not yet gained professional rank in many countries and remains a poor relation to the longer established agricultural subjects. As a result, personnel with grassland training and experience accepts employment outside of their field of specialization because of higher salaries or more favourable working conditions.

2.1.4 Research and its relation with extension

Although Arab professionals trained at foreign universities recognize the possibilities of improving grasslands, results of the few research studies which have been undertaken have not yet been widely applied.

There is no coordination between extension and research institutes in this field. However the closest possible association between research and extension is essential to bring to livestock owners and pastoralists the benefit of modern techniques and research results in grassland management.

The extensionists must rely on research workers for knowledge to be offered to the farmer and at the same time, extension must bring back to research the problems of the farmer for study and solution.

Although the need for this close association is generally recognized by the governments of the countries visited, little has been accomplished in the organizational structure of various governments to promote the interrelationship.

2.2 SUMMARY OF RECOMMENDATIONS

2.2.1 Education

Grassland management should be strengthened at all the levels of agricultural education.

(a) University level

The need for trained professionals at university level in most of the countries is acute. Governments should consider strengthening grassland management. Specific proposals are :

- i. To establish separate Faculties of animal husbandry and grassland management and improvement.
- ii. To include the pastureland subject in the curricula of the present agricultural colleges. For this purpose a team of national professionals assisted by international experts should lay down the syllabi which would fit local grassland conditions and actual needs of the country. Translating foreign syllabi is not recommended.
- iii. It would also be urgent to prepare textbooks and manuals drawn from the knowledge of local natural and social factors.
- iv. To provide up-to-date grassland education facilities to teaching institutes so that agriculture and forestry graduates could develop a sound background in the grassland management science.
- v. To give agricultural graduates the opportunity to obtain academic degrees in grassland management so that they can later provide leadership in this field. The following system is proposed :
 - In-service training for B.Sc. holders in the home country.
 - Following in-service experience, the graduate would study for M.Sc. level at one of the universities in the home country or at a university within the region.
 - M.Sc. graduates could continue the training up to Ph.D. level at home or abroad.

(b) Intermediate level

Intermediate agricultural schools and institutes could play a big role in providing the necessary technicians who would help professionals in the implementing of grassland management and improvement projects. Accordingly, grassland management should be strengthened or included in the curricula . The proposals would be :

- i. To strengthen the Arab Institute of Forestry and Rangelands, Lattakia, Syria, as a regional institute for all Arab countries to graduate more Arab technicians in this field.
- ii. To include grassland management in the syllabi of the secondary agricultural schools in Iraq, PDRY, Kuwait, Somalia and Sudan.
- iii. To include practical grazing land management in the syllabi for forest guards and forest rangers at the Forestry school of Arbil, Iraq.

2.2.2 Training

Grassland management training should be strengthened at all levels from administrators to the field. Governments and international organizations should strengthen training activities in this field as shown in the following proposals :

(a) At Government level

1. To arrange regular in-service training through refresher courses and seminars in grassland management for agricultural and forestry graduates who are assigned to grassland management work.
2. To seek financial assistance for well designed training proposals from bilateral donors who show interest in training projects.
3. To establish technical training centres at the intermediate and technical levels for field officers and rangers.
4. To train agricultural graduates in the various fields of grassland management some years in advance of the start of national projects and programmes. It is desirable to bring the projects to the operational stage when fully qualified nationals are available.

(b) At regional and international organization level

International and regional organizations can play a big role in strengthening training in grassland management. Some proposals :

1. To consider the use of on-going UNDP/FAO grassland projects as training centres.
2. To train counterpart and technical assistants in the field and in the laboratories through ad hoc short duration courses at various locations.

3. To establish a regional grassland management training team of international experts (2-4 experts) to plan and execute training programmes and prepare relevant manuals making full use of the expertise and facilities available in the countries.
4. To arrange seminars in the region for grassland professionals on specific important aspects of grazing land (range, management, development and improvement).

2.2.3 Extension

Governments should strengthen the extension services to rehabilitate grazing lands and increase animal production. Grazing lands are in fact " a people's programme" and can be successfully implemented only through their willing cooperation and conviction.

An intensive publicity and extension campaign is needed to educate the pastoralists and livestock owners so that they appreciate the value of controlled grazing and of having fewer and better heads of livestock rather than a large number of poor quality animals.

Well organized educational programmes and proper incentives are necessary to achieve this objective and grassland extension is the most effective medium for the dissemination of information on grassland and livestock.

Proposals to strengthen extension services are :

- Establishment of grazing associations which would assemble pastoralists and livestock owners, government extensionists and grassland professionals.
- Establishment of pilot demonstration projects on grassland management to demonstrate the benefits of grassland and livestock husbandry . This will do much to make new concepts acceptable to the local populations.
- Strengthening of the existing extension services through the recruitment of an adequate number of grassland extension agents. The agents must understand the problems of the pastoralists with whom they must work.
- Conducting training courses periodically to teach the livestock owners and pastoralists the value of controlled grazing and grassland management.
- Organization of farmers training centres assisted by WFP* for training of pastoralists and livestock owners in improved methods of grassland management and animal husbandry.

* World Food Programme

3. IRAQ

3.1 BASIC COUNTRY INFORMATION

3.1.1 Statistical

3.1.2 Ecological outline

3.1.3 Present forage situation

3.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

3.3 AGRICULTURAL EDUCATION. HIGHER INTERMEDIATE LEVEL

3.3.1 High Agricultural Institute, Abu Graib

3.4 AGRICULTURAL EDUCATION. LOWER INTERMEDIATE LEVEL

3.4.1 Agricultural Secondary schools

3.5 ADMINISTRATION AND AGENCIES DEALING WITH GRAZING LANDS

3.5.1 Directorate of Rangelands (Grasslands)

3.5.2 Directorate of Botany, Abu Graib

3.5.3 The Food and Agriculture Organization (FAO)

3.6 TRAINING AND EXTENSION

3.7 CONCLUSION

3. IRAQ

3.1 BASIC COUNTRY INFORMATION

3.1.1 Statistical data

1. Total area : 438,000 km²
2. Population (1975) : 10,115,000
 Annual growth rate : 3.4 %
 Rural population : 5,046,000 or 50 %
 out of which about : 20,000 nomads

3. Economics :

GNP per cap. (1975) : US \$ 343
 GNP growth per an 6.1 %

4. Agriculture :

Arable lands : 5,100,000 ha
 Permanent crops : 190,000 ha
 Grasslands : 4,000,000 ha
 Forests : 1,500,000 ha
 Others : 33,000,000 ha
 (irrigated lands 3,675,000 ha)

5. Main crops

Wheat, Barley, Rice, Dates

		<u>61/65</u>	<u>'75</u>
<u>Wheat</u>	area ha	1,210,000	1,408,000
	yield kg/ha	701	601
	production m. T	849,000	845,000
<u>Barley</u>	area ha	920,000	450,000
	yield kg/ha	925	971
	production m. T	851,000	437,000
<u>Rice</u>	area ha	86,000	72,000
	yield kg/ha	1,645	2,778
	production m. T	142,000	200,000
<u>Dates</u>	production m. T	336,000	400,000

6. Livestock (x1000)

	<u>61/65</u>	<u>'74</u>	<u>'75</u>
<u>Cattle</u>	1531	2048	2116
<u>Buffaloes</u>	238	320	332
<u>Camels</u>	200	325	338
<u>Sheep</u>	10138	15500	15829
<u>Goats</u>	2209	2584	2675

7. Iraqi dinar = 0.295 US \$

3.1.2 Ecological outline

1. The steppe region includes the foothills, upper Jazira, the Kirkuk-Arbil-Mosul plain, Makhmour and the area east of Jabel Hamrin. The region comprises the two following zones :

(a) dry steppe zone extends in a belt along the northern boundary of the desert following the 200 mm isohyet, and covers an area of about 30,000 km². The zone is completely devoid of tree growth and dominated by *Artemisia herba-alba*, *Artemisia scoparia* and *Achillea conferta*. The characteristic vegetation consists of *Poa bulbosa* and *Carex stenophylla*. In the northern portion of the zone dry farming is practised, resulting in the disappearance of natural vegetation over large areas.

(b) Moist-steppe zone extends above the dry steppe zone up to the mountain slopes and covers about 32000 km². Annual rainfall is 350-500 mm. Common grasses on uncultivated lands in spring are *Poa bulbosa*, *Hordeum spontaneum*, *Aegilops speltoides*, *Aristida plumosa*, *Chrysopogon gryllus* and *Cymbopogon olivieri*. Large areas have been brought under cultivation and the original vegetation has completely disappeared. The land which is not under cultivation is overgrazed and many unpalatable shrubby species predominate.

2. The mountain forest region

(a) Forest zone is restricted to the mountains of Iraq. Besides the dominant forest species *Quercus aegilops* there are forage legumes such as *Medicago sativa*, *M. radiata* and *Trifolium resupinatum*. Palatable perennial grasses are generally scarce but *Poa bulbosa* and annual grasses predominate.

(b) Sub-alpine zone takes place above the forest zone and extends up to the Alpine region. Vegetation is dominated by species of *Astragalus* and *Acantholimon*.

3. Alpine region : it occurs above the tree limit and extends up to 3,750 m elevation. In mid-summer, when snow melts a rich growth of grasses and forbs comes up which provides grazing to livestock for 4 months (July-October). In well drained soils wild *Medicago sativa* is common. The dominant grasses of the region are *Dactylis glomerata* and *Lolium perenne* which grow in mixture with clovers and alfalfa.
4. The desert region : the south-western desert of Iraq, covering an area of about 167,000 km², is the largest undeveloped land resource of the country. In spite of the scarcity of rainfall the region provides a luxuriant growth of annual grasses and forbs in spring beside bushes and shrubs which are available to livestock during the summer and the winter when grasses and forbs are dry. In general *Haloxylon salicornicum*, *Artemisia herba-alba* and *Rhanterium epapposum* constitute the major range cover types of the desert. The most common annual plants are *Hordeum murinum*, *Koeleria phleoides*, *Trigonella stellata*, *Medicago minima*, *M. hispida* and others.

3.1.3 Present forage situation

It is estimated that 50 % of the country consists of arid and semi-arid grazing lands and used to contain some excellent fodder plants. Over the years these grasslands have suffered a steady deterioration due to overstocking and overgrazing. In the desert region, overgrazing has been accentuated in the past by transhuming flocks coming from Syria, Kuwait and Saudi Arabia.

3.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

There are four Faculties of Agriculture in Iraq :

1. Faculty of Agriculture, University of Baghdad
2. Faculty of Agriculture, University of Bassorah
3. Faculty of Agriculture, University of Suleymanieh
4. Faculty of Agriculture and Forestry, University of Mosul

The Faculty of Mosul is the only Faculty where teaching of grassland matters takes place as a major course. It is taught to the 2nd year students in the spring semester (2 hours lectures and 3 hours practicals per week). The other three Faculties give only a course on irrigated fodder crops. There are however efforts being made for the creation of a major course in grassland management similar to the one at the Mosul University.

3.3 AGRICULTURAL EDUCATION. HIGHER INTERMEDIATE LEVEL

3.3.1 High Agricultural Institute, Abu Graib

Founded in 1970-71, it offers a 2-year course in Agriculture including practical training during summer. Grassland management is not included in the syllabi of the Institute. A course on cultivated fodder crops is given to the 1st year students in the spring semester.

3.4 AGRICULTURAL EDUCATION. LOWER INTERMEDIATE LEVEL

3.4.1 Agricultural secondary schools

There are 18 Agricultural secondary schools in the country giving a 3-year course in general agriculture. Grassland management and fodder crop courses are not included.

3.5 ADMINISTRATION AND AGENCIES DEALING WITH GRAZING LANDS

3.5.1 Directorate of Rangelands (Grasslands)

The Iraqi Government has recently recognized the importance of its arid and semi-arid grazing lands. As a result a Directorate of Rangelands (Grasslands) was established in 1976 responsible for the conservation and improvement of these lands. The main activities include protection, improving the systems of grazing, a better distribution of water points, increasing forage production and reseeding the most promising productive range species.

For this purpose, the Directorate established 10 main centres in different parts of the country. Each centre has all housing facilities for staff members and workers and feed stores with a capacity of 500 to 1000 tons. Some centres lack personnel but most are functioning fairly well.

The Directorate will implement the project "Improvement of grazing lands in the Hammad Valley" which is now under preparation by the Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD). The project will be jointly financed by Saudi Arabia, Syria, Jordan and Iraq. The El Hammad Valley project area covers 100,000 km² and covers parts of the four concerned countries. The main objective of the project is to improve grazing lands and increase livestock production.

3.5.2 Directorate of Botany, Abu Graib

The Directorate possesses a rich herbarium of about 47,000 plant specimens collected from the different ecological zones of the country. The Directorate is studying the botanical changes taking place in the range vegetation due to overgrazing and lack of protection. The FAO is assisting the Directorate by establishing a "Regional Project for Genetic Research" ORSTOM/TF-31/FAO to collect and preserve plant specimens.

3.5.3 The Food and Agriculture Organization (FAO)

The FAO has reached an agreement with the Iraqi Government to implement the project "Assistance to the Directorate of Rangelands (Grasslands)" starting in 1978 for a period of two years. The main objective of the project is to assist the Directorate in experimenting and demonstrating the best methods of grassland management and improvement and livestock husbandry.

3.6 TRAINING AND EXTENSION

Farmers training centres do not exist in Iraq. Extension work is carried out by the Directorate General of Agricultural Extension of the Ministry of Agriculture. Some training is conducted within the agricultural cooperatives in the fields of credit, planning and marketing, but not much seems to have been done on grassland and pasture management.

3.7 CONCLUSION

In the last two decades the grazing lands of Iraq have suffered, like these of other countries, from overstocking and overgrazing.

At the University level, grassland management is only taught as a major course at the Faculty of Agriculture and Forestry, University of Mosul.

Other teaching institutions have not yet included grassland or pasture crop production in their curricula.

The new Directorate of Rangelands (Grasslands) is responsible for grazing lands and pastures with the Directorate of field crops being concerned with irrigated fodder crops.

There is a general shortage of trained professionals and technicians.

4.. KUWAIT

4 .1 BASIC COUNTRY INFORMATION

- 4.1.1 Statistical data
- 4.1.2 Ecological outline
- 4.1.3 Present forage situation

4 .2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

4 .3 AGRICULTURAL EDUCATION. INTERMEDIATE LEVEL

- 4.3.1 Agricultural Institute
- 4.3.2 Institute of Technology

4.4 TRAINING AND EXTENSION

4.5 ADMINISTRATION OF GRAZING LAND AND PASTURE MANAGEMENT AND DEVELOPMENT

- 4.5.1 Forestry and Range Section
- 4.5.2 Kuwait Institute for Scientific Research

4.6 CONCLUSION

4. KUWAIT

4.1 BASIC COUNTRY INFORMATION

4.1.1 Statistical data

1. Total area : 17,820 km²
2. Population (1975) : 582,000
 Annual growth rate : 2.2 %
 Rural population : 41,000 or 1 %
 of which about : 27,000 nomads
3. Economics :
 GNP per cap. (1975) : US \$ 4794
 GNP growth per annum : 6.7 %
4. Agriculture (1975) :
 Arable lands : 1,000 ha
 Permanent crops : -
 Grasslands : 134,000 ha
 Forest : 2,000 ha
 Others : 1,645,000 ha
5. Livestock (x1000)

	<u>61/65</u>	<u>'74</u>	<u>'75</u>
<u>Cattle</u>	4	7	8
<u>Camels</u>	12	6	6
<u>Sheep</u>	10	105	108
<u>Goats</u>	48	81	84
6. Kuwaiti dinar = 0.280 US \$

4.1.2 Ecological outline

According to Kernick (1966) there are three major ecological regions though there is little real climatic data to support their exact delineation. They are :

- the inland desert of the north and west ;
- the low-lying desert plain extending from Al Atraf to the Burgan in the south, and
- the narrow coastal strip extending from Subiya on the north of Kuwait Bay to Ras al Jilaila on the coast in the south.

The erratic rainfall in the cool season and the shortage of moisture in the summer largely limit plant growth. The vegetation is chiefly composed of simple plant communities dominated by pure stands of either *Rhanterium epapposum*, *Haloxylon salicornicum*, *Zygophyllum coccineum*, *Panicum turgidum* or *Anabasis articulata*.

Kernick concluded that the vegetation of Kuwait comprises the following :

1. Coastal saltbush communities dominated by *Zygophyllum coccineum* growing in association with other halophytes.
2. Coastal sand communities : the chief constituent is the sub-shrubby desert grass *Panicum turgidum*.
3. Cyperus steppe : covers the low-lying desert plain region extending almost from Suleibiya to the Burgan and composed mainly of pure stands of *Cyperus conglomeratus*.
4. Rhanterium steppe occupies a very large area of the state and constitutes a pure stand of *Rhanterium epapposum*, a deciduous shrub.
5. Haloxylon steppe occupies large hard and sandy gravelly areas in the northern and western parts of the country and is composed mainly of *Haloxylon salicornicum*.
6. Anabasis steppe occurs in a considerable area south of Mityaka and is dominated by *Anabasis articulata* mixed in some places with *Agathophora alopecuroides*.

4.1.3 Present forage situation

Agriculture and livestock have a marginal rôle in Kuwait economy due to aridity, scarcity of water, soil deficiencies and the limited manpower trained in agricultural skills. However the development of the livestock industry has taken place at a rapid rate particularly in dairy and poultry production. There has been a progressive deterioration of the grasslands of Kuwait through overgrazing and the removal of woody shrubs for fuel.

Fodder production from natural grasslands is very limited and very seasonal due to harsh climatic conditions prevailing in the summer months. Livestock move into Kuwait from Iraq and Saudi Arabia for winter grazing. They may return to these two countries or go to feedlots for slaughter.

4.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

There is no agricultural education at this level. The University of Kuwait has no Faculty of Agriculture.

Arid zone ecology is taught at the Department of Botany and Microbiology, Faculty of Science, in the spring semester in the 4th year (2 hours lectures and 3 hours practicals per week). Principles of plant ecology are given in the 2nd and 4th years. Practical course in plant ecology includes collecting and identifying species and vegetation measurements.

4.3 AGRICULTURAL EDUCATION. INTERMEDIATE LEVEL

4.3.1 Agricultural Institute

Founded in 1969 under the supervision of the Department of Agriculture, Ministry of Public Works, it was finally closed in 1977. Courses offered were basic sciences, agriculture and animal husbandry. Grassland management was not included in the teaching curriculum of the Institute.

4.3.2 Institute of Technology

Founded in 1977 to group all the intermediate institutes including the above Agricultural Institute. Grassland management is not included in the syllabi of the Institute. An effort should be made urgently to establish a section for grassland management.

4.4 TRAINING AND EXTENSION

No official in Kuwait has received training in pastureland or pasture management. The Government has sent a female student to the USA for a M.Sc. degree in range management. The Agricultural Extension Section, Department of Agriculture of the Ministry of Work has a staff of six. Their activities include collecting information from the technical Divisions and Sections, publication of circulars for farmers, providing films and TV programmes and visits to farmers. Grazing land management and improvement extension activities play a minor rôle there.

4.5 ADMINISTRATION OF GRAZING LAND AND PASTURE MANAGEMENT AND DEVELOPMENT

4.5.1 Forestry and Range Section

It is one of the different sections under the administration of the Department of Agriculture. Unfortunately, this section has no professional staff trained in grassland or range. To carry out this sort of activity, the Section should be provided with University and intermediate level staff who are well trained in this field.

4.5.2 Kuwait Institute for Scientific Research

The Institute was established in 1967 by the Arabian Oil Company (Japan). The Arid Zone Agricultural Division of the Institute is carrying out some work on grassland management, herbarium and introduction of new forage plants. However, the Division should be strengthened to conduct research to solve the grassland problems prevailing in the country.

4.6 CONCLUSION

The livestock industry so far plays a marginal rôle in Kuwait economy due to aridity, scarcity of water, deterioration of grasslands and the limited manpower trained in agricultural skills.

There is no agricultural education in the University of Kuwait and hence no grassland management course is taught at this level. Only an arid zone ecology course is offered in the Faculty of Science.

The Intermediate Agricultural Institute, Ministry of Public Works, was closed in 1977 and is at present represented by the Section of Agriculture at the newly established Institute of Technology. Here again grazing land problems are not dealt with.

The Arid Zone Agricultural Division of the Kuwait Institute for Scientific Research established by the Oil Company, is carrying out some work on grassland management, establishment of an herbarium and the introduction of new forage plant species.

With regards to training, there is no official in the Forestry and Range Section who has received appropriate training in pasture management. The Agricultural Extension Section of the Department of Agriculture, Ministry of Work, plays a minor rôle in this field.

5. SOMALI DEMOCRATIC REPUBLIC

5.1 BASIC COUNTRY INFORMATION

5.1.1 Statistical data

5.1.2 Ecological outline

5.1.3 Present forage situation

5.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

Faculty of Agriculture, Mogadiscio University

5.3 AGRICULTURAL EDUCATION. INTERMEDIATE LEVEL

Range Management Institute, Burao

5.4 ADMINISTRATION OF RANGE AND PASTURE MANAGEMENT AND DEVELOPMENT

The National Range Agency (NRA)

5.5 EXTENSION AND TRAINING

5.6 CONCLUSION

5. SOMALI DEMOCRATIC REPUBLIC

5.1 BASIC COUNTRY INFORMATION

5.1.1 Statistical data1. Total area : 637,660 km²2. Population (1975) : 3,171,000

Annual growth rate : 2.6 %

Rural population : 1,804,000 or 56.9 %

out of which 311,000 nomads

3. Economics :

GNP per cap. (1972) : US \$ 85

4. Agriculture :

Arable lands : 1,000,000 ha

Permanent crops : 15,000 ha

Irrigated lands : 165,000 ha

Grasslands : 29,000,000 ha

Forests : 9,000,000 ha

Others : 24,000,000 ha

5. Main crops

Sorghum, Maize, Sesame with sugar-cane and banana as industrial crops.

6. Livestock (x1000)

	<u>61/65</u> (1)	<u>'74</u> (1)	<u>'75</u> (1)	<u>'75</u> (IBRD estimates)
<u>Cattle</u>	2,410	2,978	3,056	2,500
<u>Camels</u>	2,700	3,044	3,089	2,500
<u>Sheep</u>	3,672	3,911	3,922	} 15,000
<u>Goats</u>	4,604	5,050	5,100	

7. Somali shilling = 6.23 US \$

(1) FAO production yearbook 1975, vol. 29

5.1.2 Ecological outline

The flora of Somalia has been studied by Gioventa (1929), Bettini (1939), Collenette (1931), Gillett (1941), Hunt (1944) and Glover (1947) and C. Hemmings (1966, 1972). Recent reports indicate that there is widescale overgrazing of the grazing land. Accordingly, perennial grasses have been replaced by annuals and in some cases by unpalatable shrubs.

5.1.3 Present forage situation

Grasslands comprise 85-90 % of the total land area. Livestock production from this major feed resource constitutes the main economic economy of the country. Nomadic and transhumant pastoralism characterized the activities of some two-thirds of the population. In 1975 livestock export earnings were about Som. sh. 330 million.

Most of the grazing lands are deteriorating at an accelerating rate due to overgrazing and to the increasing local demand for meat and livestock products.

The recurrent droughts (every 3-5 years) cause drastic losses to livestock and accelerate the range deterioration process. The severe drought of 1970 created severe damage to the nation. An adequate grazing land management programme is needed to stop grassland deterioration and to save the greatest natural resource of the country.

Only one million ha of land are cultivated mostly under dryland farming conditions as the main limitation to cultivation is the shortage of water and not the shortage of suitable land.

5.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

Faculty of Agriculture, Mogadiscio University

A successful attempt was made by the FAO/UNDP project "Rangeland conservation and Development SOM/75/006" to initiate a University level education in range management. The project revised the curricula in general agriculture in such a way that students could major in range management starting in the 3rd year of the Faculty. All students in their 2nd year were taught an introductory course in range management and four other range subjects were taught in the range major course. Teaching was carried out by the range management and livestock officers of the project. The introductory course was attended by 32 students and 1 for the major course. Most of the students had difficulties in English and Italian languages. As a result, subjects were presented in the simplest way and the course was reasonably successful.

Unfortunately, these efforts came to an end, with the closure of the project and the teaching of range management is now absent in the present curriculum of the Faculty.

5.3 AGRICULTURAL EDUCATION. INTERMEDIATE LEVEL

Range Management Institute, Burao

It was established in 1975 as a part of the above FAO/UNDP project and supported by the Kuwait/IBRD Loan Project for the development of the Northern rangeland. Great emphasis is directed towards training technicians in range management, particularly those working with pastoralists. The Institute is well equipped with all teaching facilities but is facing the following problems :

1. An acute shortage of trained teaching staff ; there are at present two staff members carrying the whole teaching load.
2. Difficulties in finding students who accept to work after graduation in the range areas.
3. Poor students' level in English and Italian languages.

The main topics of the grassland management syllabus consist in the following items :

- components of range management
- range ecology
- basic principles of range management
- field applications of range management
- rôle of range management in watershed preservation
- range management in relation to forestry
- range economics
- range research
- public relation and extension in range resources management
- range herbarium

Total teaching hours is divided as follows :

English language	342 hours
Basic science subjects	256 hours
Technical subjects	1802 hours (33 % practical)
	<hr/>
	2400 hours

Dr. L. de Silva, UNESCO expert, commented on this syllabus and reported that practical training of 600 hours, which is only 25 % of the total 2400 hours, should be increased to 900 hours (50 % of the 1802 hours allocated for technical subjects). As a result, lectures hours have to be reduced from 1202 to 902. The mission is in full agreement with Dr. de Silva's suggestions.

5.4 ADMINISTRATION OF RANGE AND PASTURE MANAGEMENT AND DEVELOPMENT

The National Range Agency (NRA)

It was established in 1976 as an autonomous agency and following the approval of an international loan from Kuwait/IBRD funds amounting to about US \$ 20 million. The loan was allocated for the implementation of the "Northern Rangeland Development Project". The project is supervised and coordinated by the NRA.

The agency is headed by Dr. Karani and assisted by Mr. M. Awaleh who is the only postgraduate professional in range management (M.Sc.) in Somalia. Mr. Awaleh was also the Project Director of the Northern Rangeland Development Project.

The NRA is faced by a chronic shortage of trained personnel. To fill the gap in technicians at the intermediate level, the Government is sending selected secondary school graduates to be trained in range management at the following foreign institutes :

1. Animal Health and Industry Training School (AHITI), Kenya
2. Egerton Agricultural College, Kenya
3. Arusha Agricultural Training School, Tanzania

The NRA has at present 10 rangers (AHITI and Egerton) and 35 range assistants trained at the Burao Institute. These numbers are far behind the level required by the development of the grazing lands of the country.

With the assistance of the World Bank loan to the Northern Range Development Project, the NRA is implementing the following projects :

1. Drought Rehabilitation Project in selected areas
2. Ranching Cooperatives : six cooperatives were formed of the following types :
 - cooperatives whose members are rural livestock owners from nomadic/semi-nomadic people ;
 - cooperatives of urban livestock owners using the grazing land around the villages
 - livestock trader cooperatives made up of people who buy and accumulate livestock for marketing.
3. Seasonal Grazing Reserves : it was reported to the mission that there are 45 grazing reserves ranging in size from 500 to 2000 km² which are closed in the two rainy seasons and grazed during the intervening dry seasons. Few of these reserves are functioning adequately due to a lack of manpower for supervision and management and also due to the disagreement of most pastoralists with this plan.

Another similar project "Central Rangeland Development Project" is now being prepared by a World Bank mission and will be financed by the Kuwati Fund. The project might have difficulties in recruiting the necessary staff due to shortage in trained personnel existing in the Northern Project.

5.5 EXTENSION AND TRAINING

The Somali Government realized that without the fullest cooperation from the pastoralists, the administrators and technicians can do little toward implementing effective management and improvement of the rangeland resources.

The Kuwati Fund for the Improvement of the Northern Rangeland had already established a well equipped extension centre. However, lack of trained staff is hindering the activities of this centre.

Despite the shortage in trained personnel, a similar centre is planned to be established and attached to the "Central Rangeland Development Project" which is under preparation by a World Bank mission.

Beside the extension services offered in the centre, the NRA has formed the following associations :

1. Grazing Elders Association : which comprises leading pastoralists to discuss the different livestock and range problems and find out their solutions.

2. Grazing Associations : Formed in every village from selected pastoralists and livestock owners to receive recommendations and plans from the Elder Association, and also to implement technical advices laid down by the Government technicians.

5.6 CONCLUSION

The recurrent droughts, particularly that of 1970, coupled with over-grazing caused severe damage to grasslands and livestock in Somalia.

Teaching of grassland management is not included in the curriculum of the Faculty of Agriculture, University of Somalia. At the intermediate level, the Range Management Institute, Burao, which is training technicians working with pastoralists, is facing an acute shortage of trained staff. The National Range Agency, responsible for the grassland improvement and development in the country is also having similar problems and as a result, the implementation of its widescale range projects is being delayed.

6. DEMOCRATIC REPUBLIC OF THE SUDAN

6.1 BASIC COUNTRY INFORMATION

- 6.1.1 Statistical data
- 6.1.2 Ecological outline
- 6.1.3 Present forage situation

6.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

- 6.2.1 Faculty of Agriculture, University of Khartoum
- 6.2.2 Faculty of Veterinary Science, University of Khartoum
- 6.2.3 Future Universities

6.3 AGRICULTURAL EDUCATION. INTERMEDIATE LEVEL

- 6.3.1 Shambat Institute of Agriculture
- 6.3.2 Forest Rangers College, Soba
- 6.3.3 Kuku Veterinary and Animal Husbandry Institute for Animal Health and Production Technicians

6.4 ADMINISTRATION AND AGENCIES DEALING WITH GRAZING LAND AND PASTURE MANAGEMENT

- 6.4.1 Rangeland and Pasture Administration (RPA), Ministry of Agriculture, Food and Natural Resources
- 6.4.2 Agricultural Research Corporation (ARC)
- 6.4.3 Food and Agriculture Organization of the United Nations (FAO)
- 6.4.4 Sudan's Desert Encroachment Control Rehabilitation Programme (DECARP)

6.5 CONCLUSION

6 . DEMOCRATIC REPUBLIC OF THE SUDAN6 .1 BASIC COUNTRY INFORMATION6 .1.1 Statistical data1. Total area : 2.5 million km²2. Population (1975) : 17,335,000

Annual growth rate : 2.5 %

Rural population : 13,556,000 or 18 %
of which about 3,000,000 nomads3. Economics :

GNP per cap. (1975) : US \$ 150

GNP growth rate per an : 5.3 %

4. Agriculture : (1)

Arable lands : 7,500,000 ha

Permanent crops : 45,000 ha

Grasslands : 24,000,000 ha

Forests : 91,000,000 ha

Others : 115,000,000 ha

Irrigated lands : 1,500,000 ha

5. Main crops :

Sorghum, Sugar cane, Wheat, Sesame, Groundnuts, Cotton.

		<u>61/65</u>	<u>'75</u>
<u>Sorghum</u>	area ha	1,400,000	2,527,000
	yield kg/ha	897	923
	production m. T	1,256,000	2,333,000
<u>Sugar cane</u>	area ha	4,000	17,000
	yield kg/ha	29,961	83,869
	Production m. T	116,000	1,409,000
<u>Wheat</u>	area ha	27,000	243,000
	yield kg/ha	1,308	1,122
	Production m. T	36,000	273,000

		<u>61/65</u>	<u>'75</u>
<u>Sesame</u>	area ha	420,405	895,000
	yield kg/ha	424	303
	production m. T	178,338	271,000
<u>Ground-nuts</u> (in shell)	area ha	313,000	850,000
	yield kg/ha	1,050	1,294
	production m. T	329,000	1,100,000

6. Livestock (x1000)

	<u>61/65</u>	<u>'74</u>	<u>'75</u>	<u>'76</u>
<u>Cattle</u>	8,111	14,000	14,665	15,400
<u>Camels</u>	2,000	2,620	2,600	2,400
<u>Sheep</u>	8,255	13,400	14,000	16,200
<u>Goats</u>	6,579	8,600	9,300	11,300

7. Sudanese pound = 0.3976 US \$

6.1.2 Ecological outline

Harrison and Jackson (1958) recognized three natural vegetation zones in the Sudan : Desert, Semi-desert and Woodland Savannah.

1. Desert zone has an annual rainfall of 0 to 75 mm and is only briefly grazed by camels in good years.
2. Semi-desert zone covers the northern parts of Darfur and Kordofan, the northern limit of the Blue Nile Province, the Red Sea hills and the coastal plains and the northern Kassala Division. Annual rainfall varies from 75-300 mm. Vegetation is valuable for grazing and its distribution is related to soil types rather than to rainfall.

The characteristic dominant trees and shrub species are *Acacia tortilis* (Forsk) Hayne, *Maerua crassifolia* Forsk, *Acacia mellifera* Vahl, *Acacia etbaica* Schweinf and *Leptadenia pyrotechnica* (Forsk) Decne.

The dominant grass species are *Panicum turgidum* Forsk, *Cymbopogon proximus* Hochst ex A. Richt and a number of *Aristida* species.

3. Woodland Savannah is the largest ecological zone which covers 66 million ha in Kordofan, Darfur and Blue Nile Provinces. Annual rainfall varies from 300 to 800 mm. Some valuable grazing areas are found in Southern Darfur and Kordofan. Vegetation can be described as follows :

- A. in the low rainfall Savannah *Acacia mellifera* and *Acacia senegal* are the characteristic tree species. The most abundant grasses on clay are *Cymbopogon herbatus*, *Sorghum purpureo-sericeum* and *Hyparrhamia pseudocymbaria* and on sandy areas *Hyparrhenia confinis*, *Andropogon gayanus* and *Pennisetum pedicellatum*.
- B. in the high rainfall areas *Isoberlinia doka* often forms pure woodland in the lighter soils, especially in the wetter parts. *Anogeissus schimperi* occurs on slopes and terraces in an alluvial soil complex and in wetter places, forms dense woodland with a shrubby undergrowth and sparse grass.

6.1.3 Present forage situation

The Sudan is the largest country in Africa covering an area of about 250 million ha. The International Bank in 1976 estimated that the Sudan has 15.4 million cattle, 16.2 million sheep, 11.3 million goats and 2.4 million camels.

A large part of the country is desert, semi-desert or low rainfall savannah woodland. Out of the Sudan land surface, 80 million hectares can be used for agriculture and livestock production, but only 31 million ha are at present being used, of which 7 million ha as arable land and the rest for grazing purposes. Overgrazing has become widespread during the past few decades. In Kordofan the livestock population has increased nearly four-fold from 1957 to 1966 and livestock numbers continue to increase regardless of the rangelands ability to feed them and consequently desertification increases. Cultivation in marginal areas during periods of higher than normal rainfall, wood cutting, uprooting shrubs for fuel and bush fires are also reasons for range deterioration and the acceleration of the spread of the desert.

6.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

6.2.1 Faculty of Agriculture, University of Khartoum

It started in 1938 as a school of Agriculture and became a Faculty in 1956. There are nine departments : Agricultural Botany, Agricultural Engineering, Agronomy, Animal Production, Biochemistry and Soil Sciences, Crop Protection, Horticulture, Rural Economy and Forestry.

The number of teaching staff is 38 ; twenty-three members are on scholarship abroad. 1053 B.Sc. have graduated since Faculty establishment.

Students are admitted to the Faculty of Agriculture after passing the preliminary year in the Faculty of Science followed by four years at the Faculty of Agriculture ; the first three years are general for all students and the fourth for specialization in one of the following nine fields :

1. Agricultural Mechanization
2. Agricultural Economics and Farm Management
3. Animal Production
4. Biochemistry and Food Sciences
5. Crop Production
6. Crop Protection
7. Horticulture
8. Soil Sciences
9. Forestry

Range Management, as indicated in the teaching curriculum, is offered in the second semester of the 4th year as part of the Crop Production option in collaboration with the Department of Agricultural Botany ; 3 hours lectures and 3 hours practical training are given weekly for a duration of 15 weeks.

The theoretical courses include grazing management, concept of range management, vegetation, composition of ranges, grazing systems and range resources of the Sudan.

The mission feels that training in range management and fodder crops gets limited attention due to the lack of teaching staff specialized in range science in addition to a lack of transportation facilities and budgetary limitations. As a consequence, students are unable to visit and practice on the far located natural grasslands of the country. Dr. A. Osman, Plant Ecologist, who teaches the range management course suggests strengthening the curriculum of this course by increasing the teaching hours and by establishing a major in range management.

Principles of Plant Ecology, as a basic subject for range management, are offered in the second semester of the 1st year ; 4 hours lectures and 4 hours practical work per week. The course consists of the following subjects : ecosystem, ecological niche, population, some ecological factors, plant communities, plant succession, vegetation of the Sudan.

The animal nutrition course is given at the Animal Production Department in the first semester of the 3rd year ; it consists of 40 hours lectures and practicals. Ten hours are allocated to teach the nutritive value of range grasses of the Sudan including conservation of fodder crops.

6.2.2 Faculty of Veterinary Science, University of Khartoum

It was established in 1937 with 29 permanent academic staff. The total number of B.Sc. students graduated since establishment reached 251.

The 1st year students are taught the course of Feed Production for 25-30 hours. It includes the study of the ecological zones of the Sudan ; important grasses, shrubs and trees for grazing ; development of rangelands ; systems of grazing ; and pasture nomadism. Students are taken out for two-week to study practically the vegetation of Sudan.

6.2.3 Future universities

The Government of the Sudan within the national educational plan is considering the establishment of the following universities :

1. the University of Gezira ;
2. the University of Juba, South Sudan ; will be opened during the academic year 1977-1978 ;
3. the University for Natural Resources replacing the present Rangers College in Kordofan, West Sudan. Range management is considered one of the major specialization in the teaching curriculum of the proposed University.

6.3 AGRICULTURAL EDUCATION : INTERMEDIATE LEVEL

6.3.1 Shambat Institute of Agriculture

It was founded in 1954 with a total capacity of 360 students. The entrance requirement is the High Secondary School Certificate. The studies last 3 years after which students are given a diploma in agriculture which permits them to work as Agricultural Field Officers.

Courses offered are basic sciences and agricultural subjects with emphasis on practical aspects of farming and land management.

Range management is not included in the teaching curriculum of the Institute. Only a short course on fodder crops is given as part of the plant production syllabus. It was reported to the mission that graduates can enter the Faculty of Agriculture at Alexandria University, Egypt, to obtain a B.Sc. degree in Agriculture. Similarly, selected A and B level graduates are accepted in the 2nd year of the Faculty of Agriculture, Khartoum University. As a result, the Shambat Institute is gradually losing its role of supplying the country with the necessary technical assistants needed for the implementation of agricultural development plans.

6.3.2 Forest Rangers College, Soba

Founded in 1946 with a total capacity of 50 students. Theoretical and practical courses in Forestry are offered during the 2 years. No range management or forage production courses are given at the College.

6.3.3 Kuku Veterinary and Animal Husbandry Institute for Animal Health and Production Technicians

It was established in 1973 and aims at giving post-secondary level education in the fields of animal production, veterinary hygiene and extension services.

Graduates are awarded a diploma which qualifies them to work as farm managers, technical assistants and co-workers with research officers in the public and private sectors. 90 students have already been graduated.

The main constraint which hinders the activity of the Institute, as revealed to the mission, is the shortage in the teaching staff which at present consists of 7 permanent members assisted by 2 foreign professors.

Range management and fodder crop production courses are given in a 12-week course in the 1st year and also in the 2nd year. They include the following items : Range management definitions and history, Sudan vegetation zones, ecology of rangelands, effect of grazing on forage plants, plant ecology in relation to grazing, plant succession, measurements of vegetation, grazing capacity, nutrition in relation to range management, ranch operations, range improvement, factors influencing rangelands in the Sudan, nomadism, agriculture VS. range, plant palatability, role of range management in animal production, irrigated pastures and their problems, livestock off-take from production areas, current projects and range protection. These syllabi, though well planned, are very ambitious and far beyond the standard of the students of this Institute. It is crowded with theoretical rather than practical aspects of range management. Care should be directed towards condensing the courses to fit the nature of the work of the graduates who are appointed as intermediate technical assistants.

6.4 ADMINISTRATION AND AGENCIES DEALING WITH GRAZING LAND AND PASTURE MANAGEMENT

6.4.1 Rangeland and Pasture Administration (RPA), Ministry of Agriculture Food and Natural Resources

It is the Governmental body responsible for management, protection and improvement of grazing land. The technical staff consists of twenty-four members : 2 Ph.D., 10 M.Sc., 3 B.Sc. and 9 in study leave for Ph.D. and M.Sc. degrees in range management. This staff is assisted by 26 technicians at intermediate level, well trained in range management and graduated from the Animal Health and Industry Training Institute (AHITI) in Kenya. The Administration is in an acute shortage of professionals and technicians to carry out its widescale activities in the country. Shortage of transportation facilities and budgetary limitations are also hindering the work of the staff.

Three main projects were submitted by the RPA in the six-year plan which started in 1977 :

1. Range Improvement Project : will be located in the Savannah belt in Darfour and the White Nile where range resources have been deteriorating at an alarming rate due to overgrazing, fire and the extension of mechanized rainfed agriculture. Three sites have been selected representing different ecological zones : wet-season, dry season and transitional grazing areas. The three centres will

cost about 3 million sud. pounds over the six year period. A part of this budget will be allocated for purchasing and operating 7 baling units to harvest forage from productive areas and transport it to areas of high animal concentration.

2. Range Perimeters and Forage Production Project : the project is aimed at establishing range perimeters around crop-production schemes. It will also explore the possibility of introducing forage crops in rotation with rainfed and irrigated cereal crops. It is considering also the possibility of using crop residues and agricultural by products as animal feed. The total cost of the project will amount to about 93,000 sud. pounds in the six year period.
3. Cooperative Ranches Project : will be located in the White Nile Province and financed by Saudi Funds (1.2 million sud. pounds). The duration of the project will be 6 years during which three cooperative Ranches will be established to encourage nomads to provide their livestock, participate in the decision making and share the profit. These ranches would serve a dual purpose : to encourage nomads to form production cooperatives and to answer some of the technical problems associated with ranching in the rangelands of the Sudan.

6.4.2 Agricultural Research Corporation (ARC)

The ARC is one of the agricultural research agencies within the Ministry of Agriculture, Food and Natural Resources which are headed by the Minister. The ARC has 13 departments and institutes and 20 research stations and sub-stations. Out of those, two are dealing with range and fodder production :

1. Range and Pasture Research Department carried out research mainly on breeding, agronomy and adaptation of irrigated fodder crops. Limited care is directed towards range problems and the development of rainfed forage crops.
2. Ghazala Gawzat Research Sub-Station carries out limited research on range management and improvement and range ecological studies.

6.4.3 Food and Agriculture Organization of the United Nations

1. The only project carried out presently by the FAO in the field of fodder development is a small-scale (Technical Cooperative Programme) for hay baling with a budget of US \$ 18,000. This budget might be increased in 1978.
2. EMASAR is helping the Sudanese Government in the formulation of grazing land development projects (1).

(1) see Vol. VIII "Sudan - Proposals for grazing land development"

6.4.4 Sudan's Desert Encroachment Control Rehabilitation Programme (DECARP)

The programme was prepared jointly by the General Administration for Natural Resources, Ministry of Agriculture, Food and Natural Resources and the Agricultural Research Council, National Council for Research in collaboration with UNEP, UNDP and the FAO regional office for the Near East in 1976. The programme aims at controlling and rehabilitating desert encroachment in the Sudan. Desert encroachment control and rehabilitation planning, extension and development unit and development centre will be established in the six regions of the country affected by resources degradation, for a total of US \$ 26 million.

Additionally there will be an evaluation and mapping of national resources and desert encroachment monitoring unit ; stock routes will be improved and a feasibility study made for the establishment of a wildlife reserve. Funds required for the various planned activities of the national and provincial units and development centres have been apportioned by subject matter for these donors who might prefer to donate to a specific activity rather than a development unit or centre.

6.5 CONCLUSION

The major constraint hampering the development and improvement of grasslands in the Sudan is the shortage of trained personnel and experienced manpower, professionals and technicians.

Grassland management gets limited attention in the curricula of the University of Khartoum and of the intermediate level institutes. Training and extension at all levels are hindered by lack of staff, lack of transportation facilities and budgetary limitations.

The Shambat Institute of Agriculture and Kuku Veterinary and Animal Husbandry Institute should concentrate on grassland training courses to graduate the necessary technicians needed for the implementation of grazing land development projects in the country.

The proposed University for Natural Resources, replacing the present Rangers College in Kordofan might play a big role in providing the Sudan and the neighbouring countries with the necessary professionals to solve problems associated with grazing land.

7. SYRIAN ARAB REPUBLIC

7.1 BASIC COUNTRY INFORMATION

- 7.1.1 Statistical data
- 7.1.2 Ecological outline
- 7.1.3 Present forage situation

7.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

7.3 AGRICULTURAL EDUCATION. HIGHER INTERMEDIATE LEVEL

- 7.3.1 Arab Institute of Forestry and Rangelands, Bouka, Lattakia
- 7.3.2 Institute for Rural and Cooperative Development

7.4 AGRICULTURAL EDUCATION. LOWER INTERMEDIATE LEVEL

- 7.4.1 Agricultural secondary school

7.5 RESEARCH

- 7.5.1 Arab Centre for the Studies of Arid and Semi-Arid Dry Lands (ACSAD)

7.6 TRAINING

- 7.6.1 Bedouin School and Training Centre, Esserieh (Hama)
- 7.6.2 In-service Training

7.7 ADMINISTRATION OF RANGE AND PASTURE MANAGEMENT AND IMPROVEMENT

- 7.7.1 Range Steppe and Sheep Division, Department of Animal Production

7.8 CONCLUSION

7. SYRIAN ARAB REPUBLIC

7.1 BASIC COUNTRY INFORMATION

7.1.1 Statistical data

1. Total area : 185,000 km²
2. Population (1975) : 7,485,000
 Annual growth rate : 3.4 %
 Rural population : 3,907,000 or 52 %
 of which about : 14,000 nomads
3. Economics :
 GNP per cap. (1975) : US \$ 274
 GNP growth rate per an : 5.4 %
4. Agriculture
 Arable lands : 5,500,000 ha
 Permanent crops : 350,000 ha
 Grasslands : 8,700,000 ha
 Forests : 445,000 ha
 Others : 3,900,000 ha
 (irrigated lands: 500,000 ha)
5. Main crops :
 Wheat, Barley, Lentils, Chick peas, Cotton.

		<u>61/65</u>	<u>'75</u>
<u>Wheat</u>	area ha	1,396,000	1,692,000
	yield kg/ha	783	916
	production m. T	1,093,000	1,550,000
<u>Barley</u>	area ha	740,000	1,011,000
	yield kg/ha	877	591
	production m. T	649,000	597,000
<u>Lentils</u>	area ha	79,000	98,000
	yield kg/ha	801,000	681,000
	production m. T	64,000	67,000

		<u>61/65</u>	<u>'75</u>
<u>Chick peas</u>	area ha	41,000	55,000
	yield kg/ha	637	484
	production m. T	26,000	27,000

6. Livestock (x1000)

	<u>61/65</u>	<u>'74</u>	<u>'75</u>
<u>Cattle</u>	454	524	504
<u>Camels</u>	11	6	8
<u>Sheep</u>	4035	5295	5310
<u>Goats</u>	668	684	684

7. Syrian pound = 3.90 US \$

7.1.2 Ecological outline

According to Pabot (1954 and 1957) Syria is divided into four climatic regions :

1. High mountain region (anti-Lebanon and Hermon) with annual rainfall about 800 mm.
2. Mediterranean region extends from the sea-coast to Jebel Ansariyah with a rainfall of more than 600 mm. There are good grazing lands.
3. Intermediate region includes Hauran and the districts of Homs, Hama, Aleppo and Upper Jezirah with a rainfall of 300-600 mm. This region is mostly cultivated.
4. Steppe region covers two thirds of Syria with a rainfall of 100-300 mm and generally less than 200 mm.

According to Draz and El Masry (1971) the dominant species found in the steppe region include the following :

Poa bulbosa, Stipa barbata, Carex stenophylla, Aristida plumosa, Aeluropus littoralis, Onobrychis olivieri, Astragalus platyrra, Salsola vermiculata, Atriplex spp.

7.1.3 Present forage situation

The grazing lands provide the major feed resource for livestock production. Increasing human and animal populations in recent years have created heavy pressure on the grasslands causing overgrazing. In addition, dry farming has been extended to the steppe region and have destroyed by ploughing the most productive grazing areas. Uprooting of shrubs for fuel, developing water points without implementing grazing control have created additional pressures and contributed to the destruction of the natural vegetation.

The Government of Syria is now taking all possible steps to cure such situation and to improve the deteriorated rangeland, the main resource for livestock development.

7.2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

Syria has now the following three Faculties of Agriculture :

1. Faculty of Agriculture, University of Damascus
2. Faculty of Agriculture, University of Aleppo
3. Faculty of Agriculture, University of Teshrine.

The first two faculties were founded in 1961 and the third in 1976. The duration of the courses is four years after which students are awarded a B.Sc. in Agriculture. An unified curriculum covering all major agricultural subjects is offered. Practical training for 2-3 months after the 3rd year is part of the programme. Specialization starts in the 3rd year in one of the following eight subjects :

Field crops, horticulture and forestry, animal production, soils, plant protection, food science, agricultural engineering, economics and extension.

Range management is included in the syllabi as a major course. It is given in the second semester of the 3rd year for 2 hours lectures and 2 hours practical per week. Range management syllabus is composed of the following main subjects : range management science, the relation between plant physiology and range production, the relation between plant physiology and range production, the relation of plant ecology and range production, effect of grazing on forestry and water conservation, the different methods for the improvement of range condition and production and conservation of forage. The course seems to be very ambitious and covers most of the aspects of the range management science.

7.3 AGRICULTURAL EDUCATION. HIGHER INTERMEDIATE LEVEL

7.3.1 Arab Institute of Forestry and Rangelands, Bouka, Lattakia

Founded in 1961 under the sponsorship of the Arab League and is meant to train foresters and rangers for the whole region. The Institute is recognized as equivalent to 1 or 2 years of University studies for those who may wish to continue their education.

Courses in forestry and range management and improvement are taught for two years after which students are awarded an Intermediate Diploma of Agriculture. Range management is considered a major subject and is taught in each of the two years of the Institute as follows :

- Principles of range management 1st year (second semester)
2 h lectures + 2 h practicals
- Grazing plants 2nd year (first semester)
2 h lectures + 2 h practicals
- Range management and production 2nd year (second semester)
2h lectures + 2 h practicals

Students are offered satisfactory training in range aspects and the Institute is unique in the Arab World ; it should receive more financial assistance to be able to receive more students required to fill the gap in trained personnel at this level.

7.3.2 Institute for Rural and Cooperative Development

It was established by the Syrian Government and financed by the UNDP. It was operated by the ILO and FAO in association with the Ministry of Agriculture and Agrarian Reform. The Institute offers pre-service and in-service training courses for personnel working in cooperatives and rural community centres. In addition it arranges short training courses on some specialized subjects. No course on grassland management is included in the activities of the Institute.

7.4 AGRICULTURAL EDUCATION. LOWER INTERMEDIATE LEVEL

7.4.1 Agricultural secondary schools

There are at present 6 agricultural secondary schools in Aleppo, Bouka (Lattakia), Deraa, Deir-ez-Zoor, Harem (Idleb) and Selamiye (Hama). Students are offered a 3 year general curriculum covering all the main fields of agriculture. Range management is taught in the 3rd year ; one hour lecture and one hour practical per week. All students enter government service upon graduation. In the new national plan for education graduates will be awarded the "Baccalaureat" and this will permit the high level graduates to enter University. During discussion with the authorities, a request was made to supply the Institutes with films, slides and plates concerning range improvement and development.

7.5 RESEARCH

7.5.1 Arab Centre for the Studies of Arid and Semi-Arid Dry Lands (ACSAD)

ACSAD is an intergovernmental autonomous organization established by the Arab League in 1971. Its headquarters is located at Douma near Damascus and it may in the future open branch offices in other Arab states. The main objectives of the Centre are to :

- conduct regional research programmes and studies related to arid zones such as water resources, plants and animal production ;
- train Arab scientists ;
- exchange knowledge and experience among Arab States, and
- cooperate with other Arab and International Organizations.

The Administration Board is composed of member country representatives of Jordan, Sudan, Saudi Arabia, Iraq, Syria, Egypt, Kuwait, Lebanon, Lybia, United Arab Emirates, Oman and Qatar.

7.6 TRAINING

7.6.1 Bedouin School and Training Centre, Esserieh (Hama)

The school is attached to the WFP project and is one of the main constructive features of both social and technical development programme of Bedouins in the country. The centre was used for literacy courses, for training of Bedouins on simple principles of range management, particularly controlled grazing practices, sheep husbandry and elementary health and veterinary aid. The centre since its establishment in 1969 was attended by 1600 Bedouins boys and girls trainees.

7.6.2 In-service Training

The Government Hema and Sheep Production Centres, Range Cooperatives and Fattening Cooperatives play an important rôle in the in-service training of personnel as well as for educational purposes in range management and animal production.

7.7 ADMINISTRATION OF RANGE AND PASTURE MANAGEMENT AND IMPROVEMENT

7.7.1 Range Steppe and Sheep Division, Department of Animal Production

With the assistance of the W.F.P. and FAO, the Steppe Division is carrying out the following activities :

1. Development of the "Hema" Cooperative System : there are at present 25 cooperatives in operation which cover 20 % of the total range area. It is feared that this system will increase the grazing pressure on the remainder 80 % of the ranges not assisted by the cooperatives.
2. Government Range and Sheep Production Centres : the aim of the centres is to improve the range and increase sheep production through proper grazing and animal management. They also serve as demonstration and training areas to local pastoralists.

3. Government Reserve Feed Storehouses : aim at stabilizing the sheep industry by providing feed at low cost to pastoralists who do not belong to cooperatives for emergency periods.
4. Feeding and Finishing Cooperatives : aim at strengthening the existing small-scale livestock fattening and finishing industry to increase the off take of slaughter sheep from the rangelands.
5. Integration of livestock into the Farming System : by increasing fodder production and replacing the traditional fallow with leguminous forage crops.

7.8 CONCLUSION

Syria is the only Arab country where grazing land management is taught as a major course at all the Faculties of Agriculture of the three Universities, Aleppo, Teshrine and Damascus. Similarly, it is included in the teaching syllabi of the higher intermediate Arab Institute of Forestry and Rangelands, Bouka, Lattakia, and at the lower intermediate Agricultural Secondary Schools. As a result, Syria is not at present lacking the necessary manpower at the university and intermediate levels in grassland management and improvement.

Training in grassland aspects is also well considered in Syria and much attention is given to train manpower in this field from university level down to livestock owners and bedouins. There is however a recognized need for practical training at all levels.

The Steppe (Range) Division with the assistance of WFP and FAO is implementing a wide-scale plans to develop the Hema cooperative system, to improve the range condition and to increase sheep production through proper grazing, animal management, and the provision of feed at low cost.

In general, Syria is considered the leader in the Arab World in tackling grazing land problems and could become a centre to train Arab graduates in this major field.

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8. PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

8.1 BASIC COUNTRY INFORMATION

8.1.1 Statistical data

1. Total area : 290,000 km²

2. Population (1973) : 1,600,000

Annual growth rate : 2.7 %

Rural population : 910,000

out of which : 157,000 nomads

3. Economics :

GNP per cap. (1975) : US \$ 120

4. Agriculture (1966)

Arable lands : 150,000 ha

Permanent crops
(irrigated) : 20,000 ha

Grasslands : 9,000,000 ha

Forests
(mainly scrubs) : 2,500,000 ha

Others : 17,000,000 ha

5. Main crops

Cotton, Sorghum, Millet, Corn, Wheat, Barley and Sesame

6. Livestock (x1000)

	<u>61/65</u>	<u>'74</u>	<u>'75</u>
<u>Cattle</u>	71	99	101
<u>Camels</u>	45	40	40
<u>Sheep</u>	201	230	232
<u>Goats</u>	809	915	923

7. PDRY dinar = 0.343 US \$

8 .1.2 Ecological outline

Much of the country consists of a plateau which rises to higher mountains reaching an altitude of above 2,000 m along the border with the Yemen Arab Republic.

Natural vegetation is sparse and adapted to arid climate and shortage of water, the average rainfall being about 50 mm per year. Small shrubs and a few trees form the main part of the vegetation. In Wadi bottoms in which moisture is more readily available, grasses and herbaceous plants are found.

Among woody vegetation, may be found several *Acacia* (*A. tortilis*, *A. etbaica*, *A. senegal*, *A. ehrenbergiana*) as well as *Zyziphus spina-christi*, *Maerua crassifolia*, *Balanites aegyptiaca* and other drought resistant tropical species.

In general the predominant vegetative cover of the country represents a degraded stage of retrogression. The climax vegetation has probably modified because of grazing pressure and fuel wood collection.

8 .1.3 Present forage situation

Agriculture and livestock are the main occupation of about 90 % of the population. Agricultural land forms only 2 % of the area of the country and much of the remainder are grazing lands and mountains which would support seasonal grazing. Most of the goats and sheep are owned by nomad and trans-humant bedouin people. They are scattered throughout the country grazing the deteriorated grazing lands and the by-products of harvested crops. As a result conditions for livestock under such circumstances are adverse.

According to the Five Year Plan for Economic and Social Development 1974-79 of the PDRY, total value of agriculture production will be increased from Yemen Dinar 23.8 m in fiscal year 1973/74 to Y.D. 36.5 m in 1978/79. In this plan, livestock production will increase from Y.D. 9.5 m to Y.D. 13.8.

8 .2 AGRICULTURAL EDUCATION. UNIVERSITY LEVEL

The Nasser College of Agriculture established in 1973 through bilateral aid from the Egyptian Government. It is the only institution at the University level in the country and offers a B.Sc. degree in general agriculture (4 years). Grazing land management and fodder crop production are not included in the curricula of the College.

In the Agronomy Department, small scale trials are conducted on some introduced sorghum varieties.

An animal production course is taught in the second semester of the 3rd year, with 3 hours of lectures and 2 hours of practicals per week, followed in the 4th year (second semester) by a theoretical animal nutrition course.

The mission believes that the curricula should be amended to include a major in grassland management with special emphasis on practical training.

8.3 AGRICULTURAL EDUCATION. INTERMEDIATE LEVEL

Nasser Institute of Agriculture, secondary level: Established in 1969, it has a capacity of 250 students. The Institute runs a 3year intermediate agricultural courses for those with 9 years of previous schooling and awards a Secondary Agricultural Education Diploma. So far 256 students have graduated.

An animal production course is offered in the 2nd and 4th years for 2 hours (lecture and practical) a week, but it does not include grassland management and fodder production subjects.

8.4 RESEARCH AND TRAINING

8.4.1 El-Khod Agricultural Research and Training Project (PDY/71/516) and Gaar Training Centre

In 1969, a PDRY/FAO project was started at El-Kod, near Aden, with a view to develop agricultural research and training. The project which is under the Ministry of Agriculture and Agrarian Reform, completed two phases in 1976 and has laid the foundations for agricultural research and training in the country.

In 1977, a new project as a continuation of the previous two phases, has been started (PDRY 75/019 Improvement of Crop Production) to develop research and training in crop production aspects. Trials are conducted at El-Kod experimental farm, and training at Gaar Training Centre which provides training to 100 trainees at any one time. The new project has expanded its activities to cover technical guidance to state production farms which serve also as pilot and demonstration farms. Since 1970, the Gaar Training Center has offered training courses for periods ranging from 2 to 42 weeks.

Training courses include general farmers training, cooperative extension, plant protection, crops, forestry, mechanization, etc... Pre-service and in-service training for extension workers and agents of the Ministry of Agriculture last for 4 to 6 months.

No research or training in grassland management and fodder production were included in the activities of El Kod and Gaar Centres despite their important rôle in the national plan for livestock development in the country.

8.4.2 Saywun and Gaar Rural Development Centres

The two centres will be established within the Education Project which is jointly financed by the PDRY and IBRD/IDA (US \$ 5.4 million). The activities of the two centres will aim at creating trained manpower covering all the necessary skills required for agricultural development, from the experienced practically orientated university graduate down to the farmer and farm worker.

Seventeen specialized agricultural courses will be offered to all upper level technical and supervisory personnel of the state farms, all field extension agents, national crop production farm leaders, agricultural co-operatives staff and some carefully selected progressive farmers' leaders.

An animal husbandry, sheep and goat production course will be given as one of the 17 specialized courses. The duration of this course will be for 39 days (156 hours) and will include grassland management, fodder crop production and fodder preservation, nutrition, animal breeding, housing and economics.

The only criticism of this programme is that pastoralists and livestock owners are not given much attention in these training activities. There should be a simple training course given to this class of farmers to train them on all practical aspects of grassland management and livestock feeding.

8.5 ADMINISTRATION AND AGENCIES DEALING WITH GRASSLAND AND PASTURE MANAGEMENT AND DEVELOPMENT

8.5.1 UN (OTC) Project for the Development of the Northern Areas of PDRY (PDY/75/R-40)

The project started in March 1973 for the rural development in Hadramou and the Northern area of PDRY. It has entered its second phase in March 1975 for a three year period. One of the main objectives of the project is to start a grassland management programme in this area.

Several trials on the introduction of some forage crops were carried out under regular and spate irrigation. In this direction, it is planned to import reasonable quantities of seeds of the most successful species and distribute them among bedouins.

Experiments on transplanting some palatable indigenous shrubs were successful. As a consequence, bedouins were encouraged to eradicate the unpalatable plants and replace them with suitable shrubs and grasses.

The project collected samples of 360 different plant species from all over the project area and presented them after identification to El-Kod Agricultural Research Station so as to establish an herbarium in the PDRY. It is highly recommended to establish this herbarium in cooperation with the Forestry Section at El-Kod project.

The project recommended to start specific actions with a view to better manage the native grazing resources through soil and water conservation and to complement them by an extended use of irrigated fodder crops and by-products.

8.5.2 Ministry of Agriculture and Agrarian Reform

There seems to be no personnel trained in grassland and forage matters at the Ministry or in any other agencies concerned with range problems in the country. This indicates the urgent need of the nation for well trained personnel at the University level or as technical assistants. The Department of Animal Production of the Ministry of Agriculture is growing 2000 Feddans of irrigated fodder crops to supply green roughage to the five governmental dairy centres established near Aden.

The Government is building an Animal Research Station in the 2nd Governate which will include four sections : animal husbandry, animal health, animal nutrition and training and extension. It is suggested to add a fifth section to conduct research on grazing land/forage problems or otherwise included it in the activities of the Animal Nutrition Section.

8.6 CONCLUSION

Livestock production is in adverse condition due to the scarcity of the forage produced from arid grasslands. Grassland management is entirely neglected in the syllabi of the Nasser College of Agriculture, University of Aden and the Intermediate Nasser Institute of Agriculture.

At present, research and training in grassland management are not included in the activities of El-Kod Agricultural Research and Training. The proposed Gaar and Saywun Rural Development Centres might help in furnishing the trained manpower in this field.

Apart from the problem created by severe climatic conditions, the main constraint to grazing land development is the lack of trained personnel at the university and intermediate levels. This reflects the urgent need of creating a small body of professionals and technicians to implement the future projects aiming at the increase of livestock production.

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