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RANGE MANAGEMENT CURRICULUM REVIEW AND
DEVELOPMENT AT AHITI, EGERTON COLLEGE AND
UNIVERSITY OF NAIROBI

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Preface

We were honored to be a part of the overall range management education review and planning in Kenya. The insight into need, the advanced planning, and the commitment to good range management by the Government of Kenya and school personnel aided our task.

We appreciate the courtesy and assistance of Mr. Lucas Ayuko, Head of the Range Management Division, Dr. C. Karue, Dean of Agriculture at the University of Nairobi, and Principal P. T. Obwaka at Egerton and the administration of AHITI for making arrangements for visits and spare time.

The faculties of the educational institutions and the range officers of the Division of Range Management gave generously of their time and helped with interpretation of the data.

The USAID mission in Nairobi provided transportation, office space and support staff. To all these people we owe our thanks for assisting us with the preparation of the report.

Discussions with many people--students, administrators, researchers, and land managers--helped us form our opinions. (See Appendix II for a complete list.) Our impressions from these interviews and an analysis of published catalogs, handbooks, course syllabi, etc. formed the basis of two reports. The first report was written by Dwyer and circulated in March. A second preliminary report was written by Box after his discussion with people who had reviewed the Dwyer report.

We especially appreciate the critical reviews of both preliminary reports. Suggestions from the reviews have been incorporated into the final report.

Although many people have contributed substantially, the conclusions here are our own. We hope our perception of the opportunities and problems in Kenyan education are accurate. We would like to be a part of developing the vast potential for a quality education program that would not only serve Kenya's needs, but serve as a model in Africa.

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Logan, Utah
August 1978

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FINDINGS AND RECOMMENDATIONS

This study was requested by the Government of Kenya and sponsored by USAID to analyze the present and potential curricula in range management in Kenya. As a result of our investigations we submit the following findings and recommendations.

Findings

1. The rangelands of Kenya are a valuable national resource. They are producing below their potential and should improve with more intensive management.
2. Kenya has a well trained cadre of range management specialists and an organization with the potential to meet Kenya's needs. Although its range program is the strongest in Africa, Kenya still does not have enough people to meet the needs for developing its rangelands.
3. To date all B.Sc. and M.Sc. level range management personnel have been trained overseas. More of these graduates are needed in Kenya.
4. Certificates and diploma level personnel are trained at AHITI and Egerton College. Both institutions have good reputations and if strengthened should be able to meet Kenya's needs.
5. A B.Sc. program is needed in Kenya. Potential exists for such a program at either the University of Nairobi or Egerton College. If it is developed at the University of Nairobi, a range management faculty must be recruited and equipped; if at Egerton, supporting courses must be added and the range curriculum upgraded to university level.
6. The demand for M.Sc. level personnel in Kenya is limited but likely to increase. Planning for post graduate education should begin now in order to fill future needs.

7. A major deterrent to meeting the increased demand for range trained people in Kenya is lack of adequate teaching staff. Both upgrading of current staff and training of new teachers are needed at AHITI and Egerton. Recruitment and/or training of faculty at University of Nairobi is needed if a program is to be developed. It is likely that all institutions will be competing for good teachers.

8. If range management education is to be effective it has special needs for field experiences. It is rare that these needs are well understood and sufficiently supported by administration at any of the schools.

Recommendations

We recommend

1. Immediate establishment of a B.Sc. program in range management at the University of Nairobi in the Faculty of Agriculture. The supporting courses are there. All that is needed are courses in range management and appropriately trained faculty to teach them.

2. Creation of a Department of Range Management to administer the new curriculum. It is important that the curriculum have a separate identity and visability and so that the program will not be subservient to an ongoing, well-established department.

3. Planning for an M.Sc. curriculum in range management at the University of Nairobi in 5 to 6 years, after the first B.Sc. graduates have completed their program and the necessary Ph.D. faculty have begun a research program.

4. Increase of facilities and teaching staff at Egerton College. This is needed both to handle effectively the present students and the proposed two-fold increase. The number of students should grow from the present 90 to 180 by 1985.

5. Immediate start in training of new faculty for the three programs and upgrading of present staff to include

- a. M.Sc. level training for AHITI lecturers and B.Sc. level for demonstrators.
- b. Two new lecturers at the M.Sc. level and a demonstrator at the B.Sc. level, to be added to the Egerton staff. The existing demonstrator should be sent for B.Sc. training and at least one lecturer trained at the Ph.D. level.
- c. A Ph.D. level faculty of at least 4 people, to be trained for the University of Nairobi.
- d. Criteria for selection of faculty at all levels that emphasize field experience and potential teaching ability.
- e. Recruitment of expatriate faculty to teach courses while Kenyans are being trained.

6. Involvement of the teaching faculty at Egerton and the University of Nairobi in research. The research of faculty at University of Nairobi and the theses of their students should be oriented to Kenya's rangeland development needs. The third year papers from Egerton can add to the data needs of Kenya. These papers need not be elaborate but should include original investigation in rather detailed studies of range management problems.

7. Development by appropriate administrators and faculty from the three institutions of a mechanism to transfer credit from one school to another. The faculty at Kenya's range schools, while not at all threatened or apprehensive about the programs of the other, certainly do not coordinate or even review the respective curriculums. This should be

at least an annual process, whereby each could learn from the other and thus improve the continuity of information taught the students. The end result of these interactions should be a program that would allow a student to complete a higher degree without repeating courses.

8. Development of a mechanism for exchange of ideas and coordination of programs at the three institutions. We recommend an annual rangeland inspection safari for teachers of range management students--both from range management departments and supporting departments--as a suitable first step in determining appropriate roles of the institutions and relating them to Kenya's needs. We stress the need to involve people from departments other than range management as a way of ensuring that rangeland examples will be used in all classes.

9. Recruitment of students into range management to include, in addition to appropriate academic credentials, evidence that the student has an interest in and liking for the pastoral environment and rangeland problems. Recognition and appreciation of the varying traditions and needs of the different pastoralist cultures should be enhanced in the teaching programs. Most students now come from urban and small town backgrounds and are not aware of the needs, customs and values of the different pastoralist traditions. An understanding of these by the certificate and diploma holders and B.Sc. graduates is essential if the range management requirements of the ranch development schemes are to succeed. Perhaps some additional training in psychology and sociology would be appropriate.

10. Enhancement of the practical field experience of students. The April-May vacation periods should be more effectively utilized to this end. Improved arrangements must be made and better coordination between MOA and

faculty to properly attach the students at district levels during this period. It is also recommended that other vacation periods be used as well. There was a recurring complaint that new Egerton diplomates lacked the much needed practical skills.

11. Increased emphasis on showing students the importance of obtaining and maintaining good records. It is imperative that data on the vegetation and soil resources are collected periodically and consistently. Only in this way can it be determined if rangelands are being maintained or improved. Emphasis on teaching methods of sampling must be increased and the need for monitoring vegetation changes clearly shown.

12. Enhancement of education in the area of personnel and fiscal management, particularly with respect to the job description of the government employee. Most of the graduates will be involved in supervising personnel and handling fiscal resources. Administrative procedures should be taught, perhaps during the last year of the study program.

13. More emphasis on sheep, goat, and camel management on rangelands. This aspect of livestock production in Kenya has been neglected by past programs which have emphasized cattle. The increased importance of small stock is clearly apparent and their positive attributes in bush management and utilization and their obvious adaptation to arid environments make them a critical part of livestock production.

14. Continuing participation by the Government of Kenya in the education of practitioners of range management. Shortcourses and workshops should be conducted in conjunction with education institutions for people in the field. In addition, special shortcourses and training programs should be conducted in coordination with establishing Farmers Training Centers when needs arise.

15. Search for a donor to be contacted immediately and assistance sought for

- a. Bringing to Kenya people with Ph.D.'s and teaching experience in western U.S. universities to help develop and teach the courses suggested here. This is important since correct implementation of the B.Sc. and appropriate planning for the M.Sc. should begin immediately and Kenya personnel are not available.
- b. Providing two or three well-qualified range management and animal scientists during the long vacation period (April-May) to teach shortcourses for all interested faculty so that they will be able to up-date their knowledge of range management and livestock production.
- c. Training Kenyans for the faculty positions in all schools.
- d. Providing the equipment needs outlined in this report.

Implementation of Recommendations

Several recommendations have been made regarding the development of a B.Sc. program in range management at the University of Nairobi and the improvement of existing programs at the Egerton College and AHITI. The following outline of steps necessary to implement the recommendations show USAID or other possible donors where help could be given.

B.Sc. degree at the University of Nairobi

Step 1. A formal request from the Director of Agriculture to the Vice Chancellor of the University of Nairobi asking that a B.Sc. program be developed. Responsibility: Director of Agriculture.

Step 2. Response of the University to the Ministry of Agriculture and submission of budget request to the Ministry of Education.

Responsibility: Response--Vice Chancellor and/or Dean of Agriculture.

Development of budget--Dean of Agriculture.

Step 3. Development and approval of the course of study. Responsibility: Faculty and faculty senate. USAID or other donors may be asked for help in some aspects of curriculum development.

Step 4. Recruitment and/or training of faculty to teach range management. Responsibility: Recruitment--Dean of Agriculture. Training--USAID or other donors will need to provide training for 2 to 4 Ph.D. candidates for the faculty. Outside help will be needed to sponsor 3 or 5 expatriate professors of range management to teach while Kenyans are being trained for the positions.

Step 5. Upgrade library and teaching facilities. Responsibility: Faculty of Agriculture, Committee appointed by Dean. Donor help will be needed to assure proper facilities are available.

Step 6. Recruitment of first year students. Responsibility: Faculty of Agriculture.

Expanded program at Egerton College

1. Implement curriculum changes suggested in Dwyer and Box reports. Responsibility: Range faculty, studies officer, principal, Egerton College.

2. Develop funding requests for expanded program. Responsibility: Principal.

3. Recruit and train new faculty for expansion. Responsibility: Recruitment--Principal. Training--USAID or donor help will be needed for scholarship and expatriate teachers while Kenyans are being trained.

4. Expand facilities for increased teaching load. Responsibility: Principal. USAID or other donor support will be needed.

5. Improve field experience of students when employed during vacation period. Responsibility: Range Management Faculty, Head, Range Management Division.

AHITI

1. Improve training of Range Management faculty. Responsibility: Director of Training and Head Range Management Division. USAID or other donor support will be needed for scholarships. Since AHITI is the responsibility of the Director of Training and the faculty are technically members of the Division of Range Management, faculty members have a difficult time competing for existing scholarships. Separate scholarships, identified for range management teachers at AHITI, are needed.

2. Improve transport for range management. Responsibility: Principal, AHITI.

RANGE MANAGEMENT CURRICULUM REVIEW AND
DEVELOPMENT AT AHITI, EGERTON COLLEGE,
AND UNIVERSITY OF NAIROBI

INTRODUCTION

Rangelands of Kenya are both fragile and extensive. Presently some 80 percent of the land is noncultivated, most of it grazed by livestock and wildlife. If the potential of this vast resource is to be realized it will need good management techniques such as range and ranch development, grazing control, bush control, and water development. To implement these techniques Kenya must have competent, well trained personnel, and to have these personnel it must have educational systems to train them. The need for range management expertise in Africa is great. Early attempts to fill the need for range managers concentrated on sending students overseas, mainly to the United States, for training. This approach, while a sound first step, was not adequate; it was not possible to train people in the numbers needed. Certificate and diploma schools developed in some areas to train people in Africa with African examples.

Kenya has been one of the most successful countries in Africa in establishing professional range management on the land. It has an efficient and well directed Range Management Division in the Ministry of Agriculture. Over 30 people have been trained at the B.Sc. and M.Sc. level in range management in the United States and Australia. Although some have been lost from the Division to other agencies, Kenya still has the largest number of professionally trained range people in Africa.

Egerton College, which established a diploma course about 1966, has proven to be an effective school for training technicians. Its graduates have distinguished themselves when they continue their academic training in schools throughout America. Even more important, they have served Kenya well as range management officers.

The Animal Health and Training Institute (AHTI) trains Certificate level range management technicians. These people have a good record for practical application of range principles. It has become apparent to the Ministry of Agriculture (MOA) that more educated and trained personnel are needed to meet the challenge of applying proper management to Kenya's rangelands. To do this will require enlarging the present capacity of educational programs and facilities to produce certificate, diploma, and B.Sc. graduates. Kenya has a good solid cadre of range people and an organization that can make their talents useful to the country. However, there are still not enough professionally trained range people for the increasingly complex schemes necessary to increase production. There are no B.Sc. or M.Sc. curricula in Africa for training the needed professional people. The certificate and diploma courses cannot produce enough people for both the division's needs and the needs of competing organizations. The rangelands of Kenya are highly productive, but they are a challenge with their droughts, their floods and their endless problems. The need for well-trained managers is great.

Objectives of the Project Assignment

The Government of Kenya, Ministry of Agriculture, made a request to USAID for the services of a U.S. university experienced in range management education. The assignment was to study and review the

curricula at Egerton College and AHITI in relation to the needs of Division of Range Management, to recommend curricula and staff changes necessary to meet these needs, and to determine the feasibility of establishing a B.Sc. curriculum in range management in Kenya.

ANIMAL HEALTH AND INDUSTRY TRAINING INSTITUTE (AHITI)

The educational program in Range Management at AHITI is one of three in the institute. The other two are Animal Health (including production) and Hides and Skins. Graduates from the two-year curriculum are trained as technical assistants to serve as extension liason between district officers and farmers and ranchers. Approximately half the teaching time is devoted to practical training, including demonstrations, farm visits, and field work with appropriate departments of the Ministry of Agriculture. All teaching terms, three each for two years, begin about May 1, end in late March, and are 13 weeks long. However, only about 11 weeks are actually devoted to lectures and practicals. The students enrolling have seven years primary and four years of secondary education. At the time of their final exams in the eleventh year, they may indicate their intention to go to AHITI. Some 2000 applications to AHITI were made in 1977 for 130 places. The Range Management curriculum requires at least "Pass" in English and Math and "Credit" in Biology of those invited for interviews. From some 200 interviewees indicating their desire to study range management, approximately 40 were selected for the program in 1977. About 30 of the original 40 students can be expected to graduate with a certificate in two years. Upon graduation all students are bonded to work for the Division of Range Managment for two years. The reputation of AHITI graduates is good.

Curriculum Review for the Range Management Department

The faculty at AHITI presently consists of five lecturers and two demonstrators. The Head of Department, Mr. C. S. Ayiga, has a

B.Sc. (University of Arizona). A second faculty member has a B.Sc. from Texas Tech. The remaining lecturers are Egerton College diplomates. The demonstrators hold AHITI Certificates. All staff have had practical experience with the Division of Range Management. They are still technically members of the Division, but they are directed by the Division of Training. This situation has led to some frustration on the staff. Most would prefer to be under the direction of Range Management.

The staff appears to be enthusiastic and dedicated, but most expressed a concern at their inadequate academic training. We feel this concern is justified. Special skills are needed to teach at a school like AHITI. The faculty member must know his subject well and be able to apply it in practical situations. It is often more difficult to teach proper application of a principle than to explain the principle itself. We recommend that all lecturers have a minimum of a B.Sc. and three years experience. At least half the faculty should be trained at an M.Sc. level. In addition, all staff should have periodic refresher courses and/or workshops to keep them current with the jobs required of their students. At least one member of the staff should have economics training.

The teaching load is not excessive. In fact, if transport and support were available the existing size staff could train additional people.

The curriculum at AHITI was reviewed with the Head of the Range Management Department. The details of the courses of study were evaluated using the AHITI CURRICULUM as presented in the catalog (1971) and the revised range management curriculum (Mimeo 1974).

Courses in range management total 1163 hours (Table 1). This total is distributed in the following ways. A total of 447 contact hours are given to lecture, 194 to practicals. In addition there are 522 hours in "outings" from the Kabete Campus including practical range experience at Ngong Extension Center (240 hours), Kiboko Research Station (120 hours) and Naivasha Dairy Center (30 hours). The other hours of "Outings" come in Year II, Term a (36 hours), Year II, Term b (42 hours) and Year II, Term c (42 hours) (Table 1).

There are 421 contact hours given to animal health and production, the discipline used most heavily outside of range management. A total of 953 hours of instruction (725 lecture and 228 practical) (Table 2). Adding this total to the 1163 hours in range management makes a grand total of 2116 hours of instruction and practical training the students at AHITI obtain.

Recommendations for the Curriculum

There is little to quarrel with in the curriculum as given in the 1974 revisions by the range management and animal science departments. The 13 weeks of practical training and experience at Ngong, Kiboko and Naivasha are particularly impressive and no doubt add measurably to the students' abilities.

The following specific areas need to be emphasized or added to the curriculum in order to better meet the needs of graduates when they are posted in their jobs:

1. Mathematics is not shown in the curriculum. Range management courses should use examples that will indicate whether students have the equivalent of "0" level mathematics skills.

Table 1. Courses in range management taught at AHITI taken by range management assistants.

Year	Term	Course Titles	Hours			
			Lect	Pract	Outing	Total
I	a	Range Ecology/Botany	88	20	12	120
I	b	Range Pastures	132	44	0	176
I	c	Practical Range Experience at Ngong, Kiboko and Naivasha Ngong Extension Center Kiboko Research Station Naivasha Dairy Center	13	43	240 120 30	446
II	a	Range management, including range ecology, national development policies, wildlife and ranch planning	82	22	36	140
II	b	Range management, including ranch planning, management practices and ranch and range improvements.	64	45	42	151
II	c	Range management, including ranch and range improvements (bush control and rehabilitation, water development, ranch buildings, roads and stock facilities.	68	20	42	130
		TOTAL HOURS	447	194	522	1163

Table 2. Courses taken by range management assistants in other departments.

Year	Term	Course Titles	Hours		
			Lecture	Practical	Total
I	a	Anatomy and Physiology	78	12	90
		Animal Production	10		10
		Chemistry	40		40
		Physics	30		30
		Organization of Government	10		10
		Total	168	12	180
I	b	Microbiology	11	11	22
		Immunology and Vaccines	11	6.5	17.5
		Parasitology and Pathology	44	16.5	60.5
		Animal Production	22		22
		Farm Business Management	11		11
		Agriculture	11		11
		Total	110	34	144
I	c	Practical Training at Ngong, Kiboko, and Naivasha as included in Table 1.			
II	a	Animal Health	33	44	77
		Animal Production	55	11	66
		Farm Business Management	33		33
		Extension	22	22	44
		Total	143	77	220
II	b	Animal Health	44	22	66
		Animal Production	55	11	66
		Farm Business Management	33		33
		Extension	22	22	44
		Total	154	55	209
II	c	Animal Health	40	20	60
		Animal Production	50	10	60
		Extension	20	20	40
		Farm Business Management	30		30
		Government Procedures	10		10
		Total	150	50	200
		Grand Total	725	228	953

2. Ranch Business Management should be a separate course. There are three terms of Farm Business Management. The course outline for Farm Management now taken by AHITI graduates has most of the principles of economics in it but does not relate directly to ranching. Range graduates will be managers of ranches not farms. The information, while related, is not interchangeable. There needs to be sufficient treatment of economics of livestock production and marketing from the rangelands, especially pastoral areas.

3. Range-livestock interactions needs additional emphasis. Students should be taught nutritive values of range forage through various growth stages, and how this relates to animal requirements during growth, gestation, lactation and breeding.

4. Soils, their chemical and physical properties, soil-water-plant relations, the effects of these interrelationships on plant growth and distribution, need additional attention.

5. Climatic and grazing influences on vegetation and their interactions should be studied. Discussions of drought strategies are needed.

6. Pastoral grazing systems is an extremely important subject for range management students. Socio-economic characteristics of pastoral societies and cultures should be stressed.

7. Engineering aspects of the curriculum appear deficient, such as water development and maintenance of equipment and vehicles.

8. Wildlife ecology and management should be added to the curriculum, especially as wildlife and livestock interact.

The only new course we suggest is in wildlife ecology and management.

However, most of the courses should be revised adding special emphasis

on the job to be done. For instance, many of the courses were designed for Phase I of the development of Kenya's rangeland, much of that is now completed. Land tenure laws, game laws, etc. are constantly changing and the curriculum should be revised accordingly. There is evidence that courses are being updated.

Equipment

The equipment used for teaching is generally adequate for the job to be done. However, there are several areas that need improvement.

First, AHITI is not well located for a range management school. Students must travel from a metropolitan center to the range areas. Insufficient transport is available at the Institute and faculty often borrow equipment for field trips. We recommend that a 40 passenger bus and a four wheel drive support vehicle be permanently assigned to the AHITI Range Management Department. Equipment for the demonstration of range improvement techniques would also be helpful. These should include 6 knapsack sprayers, 4 power brush saws, and hand tools.

A 35 mm camera for taking pictures of class projects and providing training in the use of extension techniques is needed.

The library should be strengthened to include all relevant Kenya materials on range management and a selection of range management related journals and books with Kenya applications. At present, textbooks are not required and the student leaves AHITI with no reference materials. We recommend that the student be supplied with a collection of reference materials for his personal library. At a minimum it should include books with taxonomic keys to the major Kenyan plants, descriptive books on major animal species both wild and domestic, the new range management

book by Pratt and Gwynne (1978), and reports that have been produced on range management in Kenya.

Overview of AHITI

The program at AHITI is a valuable asset to Kenya and to the Division of Range Management. Its graduates have performed well in the field. The staff is competent, but needs additional training. Also, they would benefit from a closer working relationship with the Division of Range Management personnel. By participating in workshops and seminars at the Division, they would be better able to keep the subjects they teach current with the jobs their students will be asked to do.

EGERTON COLLEGE

Introductory Review

Egerton College has produced diplomates in range management for over a decade. Many have gone to the United States for further education at the B.Sc. and some at the M.Sc. levels. Most have been remarkably successful, reflecting favorably on the education they received in Kenya.

Range management is one of nine educational streams at Egerton. After three years of rather intensive training in range management and supporting courses, particularly animal science, the students graduate with a Diploma. Many go to work for the Government of Kenya, Ministry of Agriculture, Range Management Division usually at the district level as a range officer.

Recent implementations of rather large ranch development schemes, including group ranches and the grazing blocks in the Northeast Province, have focused attention on the tremendous need for well-trained range managers. The Ministry of Agriculture feels there is now a serious shortage of range managers to fill the important posts (ATAC 1978).

Egerton College is in an expansion program which will markedly increase their facilities. The number of graduates from the Range Management stream should at least double.

Staffing Requirements in Range Management

To accommodate the suggested changes in the curriculum as proposed in this report, the following staff requirements need to be met for the Department of Range Management:

1. Increase lecturers from the present two to four.
2. Increase demonstrators from the present one to three.
3. Increase secretarial from the present zero to one.

If the output of the Egerton Diploma graduates is to be doubled, as is currently being proposed, the lecturers must be increased to six and the demonstrators to five.

Qualifications of the staff

The lecturers at Egerton should all have at least the M.Sc. degree in range management and the demonstrators be upgraded to the B.Sc. The volume of knowledge and understanding required to teach the materials contained in the curriculum imply at least an M.Sc. level of education.

Need for staff development

Staff development must begin immediately. There are not enough M.Sc. level Kenyans available to meet the present needs of the curriculum. B.Sc. level Kenyans must be sent now to obtain the M.Sc. in U.S. Range Management Schools. They should be prepared as soon as possible to move into the expanded range management curriculum.

Equipment and Space Requirements

Among the items of equipment most necessary to carry out an adequate level of training are transportation vehicles for students. The range management curriculum, perhaps more than any other, uses the rangeland itself as a laboratory. Students must be taken to the field to observe the land and animals as they are. To describe a range ecosystem or the operation of a ranch in the classroom is simply not enough. Presently there is not adequate transport for the range management department, and

that which is available is so heavily scheduled by other courses that daylong or longer field trips are very difficult to arrange.

For these reasons it is strongly urged that a 40-passenger bus be added to the transportation pool at Ogerton College with range management classes given priority for its use. Also there is need for at least one four-wheel drive vehicle (Land Rover Stationwagon) to be used by the range management faculty in the conduct of field research and other necessary activities.

Other items of equipment needed by the range management department are:

1. 25 binocular microscopes for teaching plant identification-one per two students.
2. 25 clipping shears, one per two students.
3. 25 small spring balances for measuring clipped herbage weights.
4. 2, 35 mm cameras for obtaining teaching slides.
5. 100 small hand lenses for field identification of plants by students.
6. Herbarium supplies for development of a complete range herbarium.
7. 2 herbarium storage cabinets, large.
8. Drying oven for vegetation samples.
9. 4 hand-held calculators for classroom data analysis.
10. 50 plant presses for class use in collecting plant specimens.
11. 2 each of 6-, 10-, 20-, and 30-meter steel tapes for vegetation analysis.
12. Sampling quadrats of various sizes and shapes for vegetational analysis.

Space is needed for storage of the above equipment and that required of a small herbarium for rangeland plants.

If double the present number of students are anticipated, a large 170 m² teaching laboratory will be required. The range management classes alone would fully utilize it.

A small greenhouse would be extremely useful to the Range Management Department for demonstration purposes in teaching and for student projects. One approximately 13 x 13 m would provide the space required for such uses.

Curriculum Review and Course Suggestions

The courses outlined for the range management curriculum are those outlined and described in Egerton College Catalogue of Academic Program (1977). In this catalogue each course taught has a brief description of course content. Using this information as a guide, and after interviewing range management faculty, some suggestions are offered with respect to enhancing the course material for students studying in the range management curriculum.

Each course in the range management curriculum is listed below with suggestions for change where it was deemed appropriate, and, in some instances, comments intended to make certain courses more relevant to the range curriculum.

YLAR 1, TERM 1

HOMECE	032	Lect. 20 hrs. Planning for Better Family Living <u>Comment:</u> O.K. as described.
BIO	211	Lect. 30/Pract. 30 hrs. Agricultural Botany <u>Comment:</u> O.K. as described.
BIO	221	Lect. 30/Pract. 30 hrs. Vertebrate Anatomy and Physiology. <u>Comment:</u> O.K. as described.
CHEM	311	Lect. 20/Pract. 20 hrs. Physical Chemistry. <u>Comment:</u> O.K. as described.
ECON	611	Lect. 20 hrs. Price Theory and Market Formation. <u>Comment:</u> Needs an example of livestock and how prices and market affect the livestock enterprise.
EDUC	711	Lect. 30 hrs. Introduction to Language Communication. <u>Comment:</u> O.K. as described.
ENGIN	811	Lect. 30 hrs. Introductory Statistics. <u>Comment:</u> Use of biological data such as animal weights, growth rates, forage production, etc. would be useful examples.
*ENGIN	814	Lect. 10/Pract. 20 hrs. Elementary Sketching. <u>Comment:</u> Suggest dropping this course as a requirement to make room for additional range management courses.
*RANGE	950	Lect. 20 hrs. Ranching in East Africa. <u>Comment:</u> This is a new course to be added in the first term to introduce students to the role of range management in national development, land tenure, pastoral systems and cultures, and types of ranching organizations.
*Year 1, Term 1		Total Hours Lecture 200 Practical <u>80</u>
		TOTAL 280

*As per suggestions 30 hours dropped, 20 hours added.

YEAR 1, TERM 2

BIO	213A	Lect. 10/Pract. 30 hrs. Plant Taxonomy (Range Management) <u>Comment:</u> O.K. as described.
*BIO	214	Lect. 24 hrs. Ecology. <u>Comment:</u> Description is good but doubt there can be adequate coverage in this few hours. Needs addition of some animal ecology. Needs addition of practical. Suggest adding 10 hours lecture and 20 hours practical bringing total hours to 50.
BIO	224	Lect. 20/Pract. 20 hrs. Agricultural Entomology. <u>Comment:</u> Suggest dropping this course. Relatively few of the insect pests attack livestock or excessively damage range plants. The few specialized examples where these are critical can be handled in animal science classes and range classes. These conserved hours can be applied elsewhere.
BIO	225	Lect. 20/Pract. 20 hrs. Parasitology. <u>Comment:</u> O.K. as described.
CHEM	322	Lect. 30/Pract. 30 hours. Soil Physics. <u>Comment:</u> Examples of how physical properties of soils affect growth and distribution of range plants and plant communities would be useful.
*RANGE	921	Lect. 20 hrs. Introduction to Range Management. <u>Comment:</u> Suggest adding 20 hours practical for range management students only. This should include visits to local sites to illustrate climatic, edaphic and biotic influences.
*RANGE	924	Lect. 30/Pract. 40 hrs. Range Plants and Ecology <u>Comment:</u> This is an important course with too few contact hours. Suggest title "Range Plants and Their Values". Increase practical to 40 hours from 20. If the increased hours cannot be added to Ecology as suggested, then the necessary material must be increased here and the course titled "Range Ecology". As presently described there is a great deal of ecological information included. Is there adequate treatment of range plant identification and descriptions of East African ecosystems? Suggest moving this course from Year 2, Term 1 to Year 1, Term 2 to give adequate preparation for RANGE 923 and 925.

*Year 1, Term 2	Total Hours Lecture	130
	Practical	<u>160</u>
	Total	290

*As per suggestions--40 hours dropped, 110 hours added.

YEAR 1, TERM 3

HOMECEC	041	<p>Lect. 20 hrs. Introduction to Human Nutrition. <u>Comment:</u> This is a very useful course. Graduates should find many opportunities to apply the knowledge obtained in this course to the human situation.</p> <p>Could some attention be given to nutrition derived from rangeland animals emphasizing their values and deficiencies?</p>
AN SCI	112	<p>Pract. 20 hrs. Practicals and Demonstrations. <u>Comment:</u> This is an important course to teach the skills required of a ranch manager. Are such skills as dehorning, branding, castration, vaccination and disease recognition taught? The lack of these skills by diplomates is a criticism often voiced. Arrangements could be made with nearby ranches for this.</p>
AN SCI	122	<p>Lect. 20 hrs. Livestock Types and Breeds. <u>Comment:</u> Suggest dropping this course and add it to the production courses. Place more emphasis on indigenous breeds.</p>
BIO	223	<p>Lect. 30 hrs. Genetics <u>Comment:</u> O.K. as described.</p>
CHEM	331	<p>Lect. 30/Pract. 30 hrs. Organic and Nutrition Chemistry. <u>Comment:</u> O.K. as described.</p>
ECON	613	<p>Lect. 30 hrs. Production Economics. <u>Comment:</u> O.K. as described.</p>
*ENGIN	823	<p>Lect. 10/Pract. 30 hrs. Workshop Fabrication. <u>Comment:</u> Suggest reducing practical from 30 to 20 hrs. This term is overloaded especially if the new course "Outside Visits" is added.</p>
RANGE	923	<p>Lect. 30/Pract. 40 hrs. Principles of Range Management. <u>Comment:</u> Suggest moving much of the material on ecology and vegetation types to RANGE 924. Increase the material presented on livestock response to grazing intensity. Relate interaction of livestock nutritional needs during gestation, lactation and breeding to nutritive value of range vegetation during seasons and growth stages. Cover mineral deficiencies on rangelands. Livestock range interactions appear should add selection, preference and palatability of range forage by various species.</p> <p>Suggest decreasing practical from 40 to 30 hours to accommodate the new course "Outside Visits".</p>

*RANGE 960 Pract. 30 hrs. Outside Visits.
Comment: This is a new course suggested to support RANGE 921, 923, and 925. Whole day visits once a week to ranches and range resource areas to observe vegetation, soils, wildlife, livestock, water development, bush control, grazing systems, etc.

*Year 1, Term 3	Total Hours Lecture	180
	Practical	<u>130</u>
	Total	310

*As per suggestions--20 hrs. dropped, 30 hrs. added.

Field Attachment (Suggest name change to Field Training)

In order to strengthen the practical skills of the student the College may arrange "Field Attachment" during the long vacation-- April/May each year. During attachments students will experience:

- supervised work
- observation of well-trained personnel
- learning manual skills
- work under field conditions
- writing detailed report for College supervision

Comment and recommendations: This portion of Egerton College training has not been as effective as it should be. Here is an opportunity to enhance the practical skills of Egerton graduates, and it should be heavily stressed. Reasons offered for its lack of effectiveness have been (1) the timing comes when budgets are expended at the District Office level, the location of attachments. There is no money for transport and thus field activities are severely hampered, (2) planning and preparation are inadequate for the student attachment by

the District Office, (3) liaison is deficient between Egerton faculty and District Office personnel and (4) work agenda for the students which would provide a diversity of experience is inadequate or inappropriate. Posting for attachment should be done 4 to 5 months earlier than at present.

If these difficulties are overcome, the criticism that Egerton graduates lack practical skills and experience required of their later work will be significantly reduced. Field training should also be accomplished at other vacation periods as well.

The Ministry of Agriculture and the Egerton College officials should give high priority attention to this opportunity.

YEAR 2, TERM 1

ANSCI	112	Pract. 20 hrs. Practical and Demonstrations <u>Comment:</u> See Year 1, Term 3.
ANSCI	126	Lect. 30 hrs. Animal Nutrition. <u>Comment:</u> Emphasize the ruminant on rangelands. Forage nutritive values and digestibility of range vegetation.
ANSCI	142	Lect. 20 hrs. Animal Health. <u>Comment:</u> Add section on insects that affect animal health to overcome deletion of BIO 224 "Agricultural Entomology".
CHEM	321	Lect. 30/Pract. Soil and Fertilizer Chemistry. <u>Comments:</u> Suggest dropping fertilizer chemistry portion.
CROPS	412B	Lect. 30 hrs. Principles of Crop Production. <u>Comment:</u> Include natural forage on rangelands as an example of a "Crop".
DAIRY	511	Lect. 10 hrs. Dairy Industry in Kenya. <u>Comment:</u> O.K. as described.
ENGIN	841	Lect. 10/Pract. 20 hrs. Tractor Servicing and Operation. <u>Comment:</u> Add section on vehicle maintenance.
*RANGE	924	Lect. 20/Pract. 20 hrs. Range Plants <u>Comment:</u> This course is deleted from this Term and moved to Year 1, Term 2.
EDUC	741	Lect. 20 hrs. Psychology. <u>Comment:</u> Suggest adding this course.
*RANGE	931	Lect. 20/Pract. 40 hrs. Bush Control and Management. <u>Comment:</u> This is a new course--actually separating out a portion of RANGE 931 "Range Improvement". The lecture would cover problem assessment, bush control methods stressing the use of the goat.
*Year 2, Term 1		Total Hours Lecture 170
		Practical <u>110</u>
		Total 270

*As per suggestions--drop 40 hours, add 70 hours.

YEAR 2, TERM 2

ANSCI	112	Pract. 20 hrs. Practicals and Demonstrations. <u>Comment:</u> See Year 1, Term 3.
ANSCI	124	Lect. 30 hrs. Animal Breeding <u>Comment:</u> Stress advantages and disadvantages of cross-breeding. Give due consideration to sheep and goats.
CROPS	421	Lect. 30 hrs. Pasture and Fodder Crops. <u>Comment:</u> O.K. as described.
ECON	631	Lect. 30 hrs. Farm Records and Accounts. <u>Comment:</u> Illustrate the kinds of records a range officer must maintain in his position at the District level. Records and accounts required of the government administrators.
ENGIN	818	Surveying I Lect. 20/Pract. 30 hrs. <u>Comment:</u> Use examples of surveying techniques required for laying out a stock watering pan. Use of traingulation in mapping.
RANGE	942	Lect. 30/Pract. 80 hrs. Range Inventories. <u>Comment:</u> O.K. as described. Suggest permanently reserving a one to two hectare plot of natural vegetation. This plot could be utilized to set up permanent and random sampling locations. Students would practice vegetation analysis, comparing different methods. Data collected would be analyzed and maintained over the years. In this way each class would add the data to prior year's classes so that the monitoring would illustrate trends in vegetation change. Weather records would be maintained so that the relationship of precipitation to vegetation growth could be demonstrated. Suggest title change to "Range Vegetation Analysis". Various student projects could be conducted on the plot.

This plot must be permanently assigned to the Range Management Department.

*Year 2, Term 2	Total Hours Lecture	140
	Practical	<u>130</u>
	Total	270

*No change in hours.

YEAR 2, TERM 3

ANSCI	112	Pract. 20 hrs. Practicals and Demonstrations. <u>Comment:</u> Same as for Year 1, Term 3.
ANSCI	127	Lect. 20/Pract. 10 hrs. Animal Reproduction. <u>Comment:</u> Discuss the effect of energy and mineral deficiencies on rangelands as they affect fertility and reproduction.
*ANSCI	144	Lect. 50 hrs. Ruminant Diseases. <u>Comment:</u> Suggest changing the contact hours for range management to 30 lecture/20 practical.
ECON	621	Lect. 40 hrs. Farm Management I. <u>Comment:</u> Add "ranch management" as a new course. ECON 623 taught to range managers only.
EDUC	712	Lect. 20 hrs. Technical Report Writing. <u>Comment:</u> Move to Year 1, Term 2.
EDUC	751	Lect. 30 hrs. Introduction to Rural Sociology <u>Comment:</u> Discuss pastoral societies, their traditions, and cultures. Treat specific tribes.
ENGIN	851A	Lect. 20/Pract. 30 hrs. Soil and Water Conservation-Utilization. <u>Comment:</u> O.K. as described.
*RANGE	925	Lect. 20 hrs. Wildlife and Range Use, <u>Comment:</u> Suggest adding 20 hours practical for trips to game reserves. Discuss wildlife and livestock competition and complementarity.
*RANGE	933	Lect. 20 hrs. Grazing Systems for Rangelands. <u>Comment:</u> This is a new course--separated from RANGE 951 "Range Planning and Grazing Management". This is to permit more complete coverage of range planning and its implementation. Covered in the course would be types of grazing systems, their advantages and disadvantages. Selection, design and requirements of grazing systems. Planning and establishment of grazing systems. Methods of livestock control.
*Year 2, Term 3	Total Hours Lecture	200
	Practical	<u>100</u>
	Total	300

*As per suggestion drop 0 hours, add 40 hours.

Tsavo Park and various ranches. Discussion of problems facing range technicians in the field.

*Year 3, Term 2	Total Hours Lecture	150
	Practical	<u>120</u>
	Total	270

Total does not include RANGE 961

*As per suggestions, drop 0 hours, add 20 hours.

YEAR 3, TERM 3

ANSCI	115	Lect. 20 hrs. Discussions and Seminars. <u>Comment:</u> O.K. as described.
ANSCI	148	Lect. 10 hrs. Plant Poisoning. <u>Comment:</u> O.K. as described.
ANSCI	161	Lect. 10 hrs. Hides and Skins. <u>Comment:</u> O.K. as described.
EDUC	756	Lect. 20 hrs. Government Procedure. <u>Comment:</u> Include GOK perso-nel people to give examples. Also examples of government forms, etc.
RANGE	911	Lect. 20 hrs. Seminar. <u>Comment:</u> O.K. as described.

*Year 3, Term 3	Total Hours Lecture	80
	Practical	<u>0</u>
	Total	80

*No changes suggested. The teaching portion of this term is five weeks long. The remainder of the term is reserved for final examinations.

Overview of Egerton College

A total of 500 contact hours is taught in range management under the present curriculum, with 200 hours lecture and 300 hours practical. The hours of practical include the 130 taught as Field Observations. The revised curriculum would increase this total by 230 hours (70 lecture/160 practical hours) making 730 contact hours in range management.

The current fall range management curriculum comprises 1,420 hours lecture and 830 hours practical, making 2,250 contact hours in all. The revised curriculum, as suggested in this report, would now have 1,380 hours lecture and 940 hours practical for a total of 2,320 contact hours, increasing the total contact hours by 70.

The present curriculum in range management has in it 480 contact hours in animal science, almost as many as in range itself. This is as it should be since livestock are the principal product of rangelands and range management must have more than passing knowledge related to livestock. The suggestions offered here will not diminish the strength of the range management curriculum in animal science courses.

All the faculty from sister departments interviewed stated that range management students were some of the best and most dedicated in their classes. Most faculty recognized the need to emphasize range management examples in their classes. Unfortunately few of the faculty have rangeland experience. Therefore, it would be desirable to hold workshops, study safaris, etc. for faculty who teach the range management students. They could be assisted in collecting relevant examples of problems and exercises that could be used in the classes.

The lack of adequate field experience is likely to be a problem that will require continuing attention. First, the need for transport

and field trips is higher in range management than in most curricula. We underscore again the urgent need for a medium size bus with clearance and low gear ratios suitable for negotiating sharp turns on rough roads. In addition, a four wheel drive station wagon is essential for faculty use in setting up the field work and as a support vehicle to accompany the bus on field trips. Without transport, students will not be able to work in rangeland areas.

Secondly, the curriculum calls for practical work experience during vacation periods. The quality of this experience varies. Some students get excellent training and are supervised in several practical situations. Others find themselves doing routine work of little training value. The quality of experience will always vary, depending on the needs of the employer and the employer's ability to supervise. For this part of the training to be most useful it will need special attention and coordination by the range management faculty and the employers of the students.

Neither the studies officer nor Principal P. T. Obwaka saw any major problems in the implementation of the curriculum. However, additional space and staff will be needed if Egerton College is to meet its stated goals of doubling in five years. Campus planning and architectural work is nearly complete and if money is made available the physical facilities should be finished on schedule. Staffing will be a much more difficult problem. In range management the recruitment of three new faculty members seems a minor problem, but in fact these people will probably not be available. AHITI plans staff expansion and the University of Nairobi plans a B.Sc. in range management. At the same time the Division of Range Management is upgrading its positions, and international groups are competing for the range

management graduates in Africa. If three new faculty are to be added they must be hired from other groups, recruited from outside Kenya, or trained over the next five years. It is unlikely that Kenyans can be recruited from other agencies. The use of expatriates on a long term basis is not in the best interest of Kenyan education. Therefore, additional training of present faculty appears to be most logical course. When existing personnel are being trained the usual result is temporary replacement with inexperienced people. Training of new people may take three or more years. To minimize disruption of curricula and loss of quality of teaching, training should begin immediately. The development of new faculty should precede the construction of facilities.

Overall the range management program at Egerton appears well-organized and healthy and the course sequence is appropriate and logical. The expansion program has been well-planned and should succeed with a minimum of trauma normally associated with rapid growth. It is hoped that the suggestions offered will add to the already strong program in range management at Egerton College.

UNIVERSITY OF NAIROBI

The University of Nairobi does not now have a B.Sc. curriculum in range management, but the potential for its development is good. The basic science courses and many of the special agriculture courses already exist. One faculty member will soon finish his Ph.D. in range management. A faculty committee is at work on curricula and budget estimates. Therefore, we present our analysis with optimism that a program will soon be implemented.

Role of Range Management at University of Nairobi

The course of study known as range management was developed in western U.S. universities to fill a need not being met by the fields of agronomy and animal husbandry, primarily the need for a study of the interactions between livestock and natural vegetation. It was early recognized that agronomic principles could not be used to describe or explain the influences of grazing animals on vegetation. Since the reactions of plants and plant communities to grazing is their natural response to environmental stresses it was soon realized that many disciplines of natural science were involved. The science of range management utilizes several important agricultural and biological sciences, synthesizing them into a meaningful and necessary discrete body of knowledge, that is applied to the management of arid and semi-arid rangelands. The principle disciplines involved are animal science, soil science, crop science, wildlife management, water development and use, plant taxonomy and plant physiology. Ecology, the study of organisms in relation to their environment, is the thread that binds them all together and thus constitutes the real framework upon which range management is built.

The same subjects are needed to support the study of range management as those for most other important disciplines in agricultural science. Examples of these supporting subjects are economics, social and cultural sciences, chemistry, mathematics, statistics, and biology.

Very probably range management can be credited with developing the first systems approach to use and management of natural ecosystems. Early studies of rangelands soon showed that whenever one component of the ecosystem is affected, this in turn affected to some degree all other components.

Being a relatively new field of study, range management does not have the immediate need for identification by agriculturalists as do long standing and well-recognized fields such as animal and crop sciences. Nevertheless, it is equal in importance, especially where livestock production on arid and semi-arid lands is a significant component of land use.

The role of range management in a Faculty of Agriculture should be an important one, with a separate identity from the other fields of study. It should contribute significantly to both crop science and animal production curricula. Range management is necessary to complete understanding of arid land agriculture, since rangelands make up some 80 percent of Kenya's land area and perhaps as much or more in east Africa.

There is a serious need that at least one course in range management be added immediately to the course of study for the B.Sc. in Agriculture. (See Appendix I for detailed course outline.) Livestock production in the arid and semi-arid regions becomes all the more important as the high potential areas are converted to cultivation and intensive agriculture.

B.Sc. in Range Management

There is little doubt that Kenya is ready for and capable of mounting the B.Sc. degree in Range Management at this time. It appears that this degree program could be located in the Faculty of Agriculture at the University of Nairobi, Kabete. There has been discussion of mounting such a program at Egerton College, but 1) diploma graduates in range management of the quality Egerton produces are still badly needed and 2) Egerton College lacks adequate support courses. The University of Nairobi has a well-recognized faculty of agriculture and all the basic supporting courses a strong B.Sc. curriculum needs. All that is required is the addition of the necessary range management courses and properly trained staff to teach them.

The need for Kenya personnel trained in range management was identified in the early 1960's. The Animal Health and Industries Training Institute (AHITI) at Kabete and Egerton College at Njoro included education in range management for certificate and diploma level graduates. At that time the range management program in the Ministry of Agriculture (MOA) was just emerging, and students from these institutes played important roles in filling the need through the mid-1970's.

With the development of Phase I of the livestock and ranch development program for Kenya the complexity of the programs increased and the need for better trained personnel became apparent. Now, as Phase II progresses, it is all the more obvious that personnel with at least the B.Sc. degree in range management are needed to direct and manage the emerging programs.

Among the important skills required of MOA range managers are techniques and methods of measuring vegetation and monitoring range use, documentation, record keeping, and fiscal management of range management activities and programs, and, most importantly, range management planning, plan implementation and plan monitoring. This is not to de-emphasize the necessity of adequate knowledge of livestock husbandry and management, range improvements, rural development, sociology, customs and traditions of the pastoralist cultures. This depth of education is simply not possible at the certificate and diploma level, and to be a District Range Officer today requires such knowledge.

The above described knowledge and training are not alone sufficient. Practical experience is required to temper the education and make it more useful. New B.Sc. graduates will be able to adapt more quickly and apply their education to particular situations, because they will have the basic supporting coursework enabling them to do so. We again emphasize the need for practical experience, but only time will provide it. Too often, recent graduates are moved to positions of responsibility that require experience they have not yet attained.

The development of an M.Sc. curriculum in Range Management for possible implementation in five to seven years appears to be desirable. By that time there should be adequate Kenyan faculty at the Ph.D. level who have had experience producing B.Sc. graduates and have established a research program. Experience in range research is necessary before launching a higher degree program. It is neither appropriate nor efficient to mount an M.Sc. before the B.Sc., but it certainly is critical to begin planning for its later development.

In a report to FAO, Rome (Strange 1977) it was strongly recommended that a B.Sc. in range management be mounted at the University of Nairobi. This followed a review of range management education in Kenya, Tanzania, Botswana and Swaziland. Kenya was pointed out as having a strong, ongoing program and a well-recognized unit of government in the Range Management Division of the Ministry of Agriculture. The report emphasized that a well developed program in Kenya could serve other East African nations.

The recent report by the American Technical Assistance Corporation (ATAC 1977) recommends that the University of Nairobi should seriously consider establishing a full B.Sc. degree program in range management. The report estimated the number of M.Sc., B.Sc., Diploma and Certificate graduates that would be needed by 1988 (Table 3).

In our opinion, the numbers of range management graduates that will be needed in the next ten years have been grossly underestimated. The manpower survey (Strange 1977) estimated that 80 B.Sc. graduates would be needed by the Ministry of Agriculture and an additional 5 in the commercial sector. The Range Management Division alone will need more than the amount estimated. In addition other ministries will require staff trained in range management. The new training institute for the Department of Tourism and Wildlife at Naivasha will soon be recruiting 20 faculty, part of which should be trained in range management. In addition, the staff in the Wildlife Division should include several B.Sc. in Range Management.

Staff increases in the teaching programs at AHITI, Egerton, and the University of Nairobi will need 8-12 additional faculty. Most of these will have B.Sc. degrees in Range Management.

Table 3. Presently in post and projected needs for M.Sc., B.Sc., Diploma and Certificate graduates in Range Management.
Taken from ATAC Manpower Survey 1977.

Organizational Group	In Post 1977	Projected Needs	
		1983	1988
Ministry of Agriculture			
M.Sc.	3	7	12
B.Sc.	27	67	80
Diploma	52	50	53
Certificate	119	158	188
Other Ministries			
M.Sc.	1	0	0
B.Sc.	0	0	0
Diploma	0	15	35
Certificate	1	35	91
Commercial Sector (Includes all business interviewed)			
M.Sc.	0	0	0
B.Sc.	3	5	5
Diploma	1	1	1
Certificate	0	0	0
Totals			
M.Sc.	4	7	12
B.Sc.	30	72	85
Diploma	53	66	89
Certificate	120	193	279

The demand in the private sector is difficult to estimate. More than 100 ranches are planned for Kenya over the next decade. Many of these will find it useful to have a B.Sc. manager. International groups such as ILCA, FAO, UNEP, and KREMU will employ range managers if they are available.

The report by Pratt (1975) on range research in Kenya points out the need for post-graduate personnel to develop the urgent research programs required to sustain emerging national programs. The research staff, estimated at 30, would need a support staff of perhaps three times that number. Presumably half would be B.Sc. level graduates. It is thus apparent there is an immediate need, and without question a continuing one, for B.Sc. graduates in range management. There is little doubt as well that if a range research program is implemented there will be demand for M.Sc. students.

The natural evolution will be to continually upgrade the level of training required for various positions. What was adequate training five years ago is no longer sufficient and the same will be said five years from now. The sooner Kenya moves to provide this increased educational training in range management, the better off the livestock production programs of the country will be.

In our opinion at least 200 B.Sc. graduates will be needed in the next 10 years for Kenya alone. If the University of Nairobi develops its potential as a regional educational center for African range managers, the numbers of students needed could easily reach 400 over the next decade.

Strange (1977) pointed out the deficiency in African technical literature, and this could be a major constraint in education. However,

one cannot wait on the other. Each must move forward; the research will develop the literature base, and education will demand that a literature base be formed. Another point Strange effectively made in his report was that an "African-based" curriculum in range management was essential to make the study relevant to the African situation. Curricula elsewhere, particularly in the U.S., do not adequately address the pastoral development, planning, and administration systems operating in East Africa. The unique nature of African rangelands and their cultural heritage must be the essence of the curriculum, and this cannot be taught anywhere but in Africa. We believe Kenya provides the proper setting for an African curriculum.

Proposed B.Sc. Curriculum in Range Management

In view of the importance of rangelands in Kenya and East Africa and the current national emphasis being given to range and ranch development, it is realized that Kenya and East Africa need highly trained and educated personnel to manage the vast and vital rangeland resource.

Recommendations

1. A new Department of Range Management should be established within the Faculty of Agriculture of the University of Nairobi, as per Statute XI.
2. The University of Nairobi should confer the Degree of Bachelor of Science (Range Management) denoted as B.Sc. (Range) as per Statute XIII.
3. Research in rangeland ecology and management should be an important component of the new Department of Range Management so that it

can assume national responsibility and leadership in the acquisition and dissemination of knowledge related to rangeland ecosystems and their products.

4. The B.Sc. study program should be conducted as follows:

Admission requirements

Admission requirements shall be the same for the B.Sc. Range Management as for the B.Sc. Agriculture as given on page 60 of the 1977-78 University of Nairobi Calendar. A.1 through A.5.

Curriculum

In the following curriculum the new courses are marked *. The new courses are described at the end of this section.

	<u>First Year</u>	<u>Hours</u>
1. Introduction to East African Agriculture (Field Trips)		50+
2. Mathematics		50
3. Chemistry		110
4. Zoology for Agriculture		130
5. Physics for Agriculture		50
6. Biochemistry		90
7. Statistics		64
8. Taxonomy of Higher Plants (page 347)		40
* 9. Ranching in East Africa		40
*10. Introduction to Range Management		40
*11. Range Ecology--East African Ecosystems		40
12. Plant and Crop Physiology		65

<u>First Year (continued)</u>	<u>Hours</u>
13. Animal Physiology	65
14. Economics I	45
(Note: Courses 8, 9, 10, and 11 takes the place of Botany for Agriculture (130 hours) and Genetics and Principles of Breeding (90 hours))	

<u>Second Year</u>	
15. Economics II	40
16. Farm Management I Note: Examples of ranch management would have to be included.	70
*17. Range Plants and Their Values (40 lect./40 pract.)	80
18. Animal Production I	170
*19. Principles of Range Management (50 lect./30 pract.)	80
*20. Methods of Rangeland Inventories (30 lect./50 pract.)	80
21. Agricultural Engineering I Note: Aspects of water development for rangelands must be included.	140
22. Soil Science I	110
23. Agricultural Policy Note: Policies related to range and ranch development must be included.	40
24. Agricultural Law	24
25. Ranch Practice (9 weeks practice on selected ranches during the 4th term)	
(Note: Courses 17, 19 and 20 take place of Rural Sociology (40 hours), Rural Development (40 hours) and Crop Production I (100 hours).)	

<u>Third Year</u>	
*26. Economics of Livestock Production on Rangelands	40
27. Animal Production II	50

<u>Third Year (Continued)</u>	<u>Hours</u>
28. Agricultural Engineering II	80
29. Soil Science II	110
30. Animal Health and Hygiene	50
*31. Range Improvements and Grazing Systems (60 lect./20 pract.)	80
32. Agricultural Marketing	40
33. Agricultural Extension	40
*34. Ranch and Range Management Planning (40 lect./20 pract.)	60
*35. Range Management Seminar	20

(Note: Courses 26, 31, 34, and 35 take the place of Farm Management II (40 hours), Crop Production II (110 hours), Crop Protection (150 hours), and Food Technology (40 hours).

Discussion of the proposed curriculum

Eleven new courses in range management have been added for a total of 660 contact hours, and nine courses have been deleted totalling 740 hours. For the first year there are 879 contact hours, second year 834, and the third year 570, for a grand total of 2283 contact hours, not including Ranch Practice in the fourth term of the second year. The strength of the Agricultural Curriculum is put to use with 335 contact hours in Animal Production, 220 in Soil Science, 254 in Economics, and 220 in Agricultural Engineering.

Titles and Descriptions for Suggested Range Management Courses

Ranching in East Africa

Importance of range management in the development of East Africa. Land tenure systems. Relationships between various pastoral societies and the land. Nomadism and transhumance and their impact on land

management. Types of ranching organizations--group, cooperative, company, partnership, individual and grazing blocks. 40 hours.

Introduction to range management

Nature and scope of the science and art of range management. History of its development and relationship to other disciplines. Description of the course of study for the B.Sc. Importance of the field to developed and developing countries. Interrelationships of climatic, edaphic, and biotic factors. 40 hours.

Range ecology--African ecosystems

Location and description of ecosystems in Africa with special emphasis on East African ecosystems. Edaphic, climatic and biotic characteristics. Major plant and animal species as dominants and their role in each ecosystem. 40 hours.

Range plants and their values

Identification and description of the important plant species of Kenya and East Africa. Uses and values of the various species for man, livestock and wildlife. Ecological characteristics and adaptations. 80 hours (40 lecture/40 practical).

Principles of range management

Using ecology as it applies to management. Use of rangelands by livestock and wildlife and their impacts. Grazing in relation to plant ecology and physiology. Range management for sustained livestock production. Range sites and condition classification. Balancing forage with livestock numbers. Wildlife considerations. Relationships between nutrition of livestock and nutritive value of vegetation through seasons,

especially during gestation, lactation and breeding. 80 hours
(50 lecture/30 practical).

Methods of rangeland inventories

Use of techniques adapted to the inventory of rangeland ecosystems, especially vegetation. Methods of estimating herbage production and forage for various animal species. Methods of determining botanical composition including line transect, line-point, step-point, belt transect and frequency. Estimates of grazing capacity. Determination of utilization. Air photo interpretation and mapping. 80 hours
(30 lecture/50 practical).

Wildlife and livestock grazing interactions

Competition and complimentary of wildlife and livestock species. Values and problems associated with wildlife in East Africa. Population dynamics. Multiple-use aspects. Wildlife ungulates, their status, ecology and distribution. Visits to game parks 60 hours (40 lecture/20 practical).

Range improvements and grazing systems

Bush control and management. Value of goats in bush management. Rangeland rehabilitation through seeding. Water management in arid zones. Fencing for livestock control. Role of fire in rangelands and its use as a tool for management. Various grazing systems and schemes and their relation to climate, growing season and animal requirements. 80 hours
(60 lecture/20 practical).

Ranch and range management planning

Values of short and long term planning for range livestock production. Development of a ranch plan and methods for determining livestock and range needs. Record keeping for the informed manager. Livestock improvement and grazing system plans. Costs and benefits associated with ranch improvements. Role and need for livestock economics and marketing in the plan. Implementation and monitoring of the ranch plan. 60 hours (40 lecture/20 practical).

Range management seminar

Invited specialists present a two-hour lecture once each week on various range related topics. Students have assigned written topics and literature review. 20 hour lecture.

Ranch practice

A practical course during the fourth term of year two in which the student is attached to a ranching enterprise. A detailed report will be required of each student.

Economics of livestock production on rangelands

Socioeconomic characteristics and classification of various farm and ranch livestock enterprises. Factor prices, factor proportions and livestock productivity. Economics of forage utilization by animal species and nutrient requirements. Benefit/cost ratios of various ranch development schemes. Case studies. 40 hours.

Total Contact Hours -- New Courses -- 660

Staffing Requirements

To accommodate the recommended curriculum for the B.Sc. in Range Management and to man the new Department of Range Management the following staff requirements need to be met:

1. Four Ph.D. level lecturers
2. One technician--B.Sc. or M.Sc. level
3. One departmental secretary

The volume of knowledge required to properly teach a strong B.Sc. curriculum in range management, and most especially to plan and implement the future M.Sc. curriculum, certainly will demand the Ph.D. level of training.

Staff development

Development of Ph.D. trained Kenyans must begin immediately so that the need for staff to teach the curriculum can be met. The cost of this should be supplied through grants from donor agencies. It requires a minimum of three full years beyond the M.Sc. degree to complete a research Ph.D. degree.

Equipment and Space Requirements

Equipment

Items of equipment necessary to conduct an adequate program in range management, both teaching and minimum research, are as follows:

1. One 45 passenger bus for transport of students to the field during the practicals.
2. One Kombi Van for use by the range management faculty.
3. One Land Rover Station Wagon for use in range management research.

4. Camping gear for 50 people.
5. Compasses.
6. One each of 6-, 10-, 20-, and 30-mt. steel tapes.
7. Sampling quadrats of various sizes and shapes.
8. 40 pair clipping shears for class use.
9. Schultz sampling board for demonstration of sampling procedures.
10. Two 35-mm cameras.
11. 40 small spring balances for student use.
12. 100 small hand lens for student use in plant identification.
13. 25 binocular microscopes for use in plant identification labs.
14. Herbarium supplies.
 - a. Mounting paper
 - b. Storage cabinets
 - c. Chemicals
15. Hand operated spraying equipment for small plot demonstrations.
16. 5 soil augers.
17. 50 plant presses for student plant collections.
18. One large drying oven for plant samples.
19. Files and desks for offices.
20. 4 hand-held calculators.

Space

1. 5 staff offices.
2. One technician office.
3. One secretarial office.
4. One storage room for teaching and research field equipment.
5. One departmental office (could include secretarial).
6. One teaching laboratory for 50 students including a small room for herbarium storage.
7. One lecture room for 50 students.

Library

The library should be strengthened by increasing its size and adding to its holdings. The facility has adequate space for the present offerings, and with the new range program will be so crowded as to be almost useless. At present all literature in the library is related to current programs. Few publications are on hand for range management. An immediate need is to add books and journals on ecology, botany, wildlife, pastures, and range management. All back issues of the Journal of Range Management need to be obtained and available in the Kabete Library. The journals Ecology and Ecological Monographs need to be acquired for the library.

Overview of University of Nairobi Range Management Opportunities

Potential curricula in range management have been suggested by an internal study committee at the University of Nairobi and by outside consultants. All show that a B.Sc. can be added with a minimum of new courses.

There are differences of opinion among the University faculty regarding the program. Some, including the range management curriculum study committee, favor a B.Sc. program. Others favor a post-graduate diploma following the B.Sc. in Agriculture. Still others want a M.Sc. program.

There are advantages and disadvantages of each suggestion. Our recommendation is conditioned strongly by the fact that range management requires a strong ecological orientation. In some ways it is as much a state of mind--an attitude toward the land--as it is a curriculum. It is unlikely that students from pastoral backgrounds would be attracted to the standard B.Sc. in Agriculture. It is even less likely that

students with an agricultural orientation would spend the extra year of post-graduate training to work in an area that is not familiar to them.

The B.Sc. program in Range Management is ready for implementation. Support from the Ministry of Agriculture . . the form of a letter requesting the program should allow the University to get the new staff authorized by the Ministry of Education.

Our examination of the Agriculture curriculum shows that range management education is sadly missing. Certainly if there is need for a Department of Forestry and a B.Sc. in Forestry in a country that is largely nonforested, there must be a need for as much in range management.

TRAINING OF FACULTY AT AHITI, EGERTON COLLEGE, AND
AND THE UNIVERSITY OF NAIROBI

It must be recognized that development of a curriculum is not enough. Course content and quality of that curriculum largely depend on the knowledge of the teachers and the seriousness and devotion they bring to their work. Therefore, the quality of the range management programs at all schools will be directly related to the training, experience and dedication of the faculty. All lecturers at AHITI and Egerton should eventually have at least the M.Sc. degree and plans should be made to up-date them periodically through shortcourses and training sessions. University teachers and teachers at colleges involved in research should have Ph.D. training.

One cannot expect the lecturers to keep abreast of the current thinking in a science without the opportunity for continued education. Means must be provided for faculty to attend symposia and other meetings where ideas are exchanged and research data presented.

Knowledge in range management is developing rapidly in the U.S., Australia, and elsewhere, and many principles and concepts are being revised. It is imperative that the new information is constantly made available to the lecturers in Kenya. This could be done by bringing two or three well-known range management and livestock scientists to Kenya during the long vacation period, to provide shortcourses to the range and animal science lecturers and demonstrators and perhaps others in the Range Management Division of the Ministry of Agriculture. With proper planning university credit for such courses could be arranged through participating U.S. universities.

This program would result in a valuable interchange of ideas, with a great deal of learning by both the U.S. scientists and those from Kenya.

An annual in-country workshop, perhaps sponsored by GOK with USAID support, that could bring faculty from the three schools together would be helpful. The workshop should include teachers from disciplines other than range management, as well as the core range staff of the schools. The interaction of the faculty and their response to the practical problems presented by government would benefit all.

RELATIONSHIP BETWEEN RESEARCH AND THE CURRICULA IN KENYA'S
RANGE MANAGEMENT SCHOOLS

Kenya is unfortunately lacking in much of the basic data necessary for adequate management of rangelands. Some examples are 1) primary productivity of important grazed ecosystems and major vegetation types in relation to climatic, edaphic, and biotic variables, 2) autecology and synecology of range plants and plant communities, 3) range site determinations, and 4) range condition classification. The lack or deficiency of African technical literature on rangelands is a major drawback to their proper management.

The potential for range research to support the B.Sc. and later post-graduate degrees is excellent. GOK experiment stations and the FAO sponsored work are available for cooperative efforts.

In addition, the University has acquired a 4771 ha property near Kibwezi. It is to be developed for farming systems for marginal lands. Any farming system used will include an integrated livestock-crop production program.

The GOK research station at Kiboko is near and in a similar ecological zone. The opportunity to develop range research jointly at the two stations is an opportunity that few Universities enjoy.

We recommend that the new station be developed immediately and that its research program compliment and build upon that already underway at Kiboko. Special attention should be given to use of B.Sc. Honors, M.Sc., and other post-graduate students in the research at both the new station and the one at Kiboko.

The teaching of principles and the development of knowledge cannot be easily separated. The process of discovery is a sound teaching technique. The same skills are used in problem solving in research.

New information is needed for each new phase of Kenya's rangeland development. It is desirable that research efforts be related to the problems faced by the manager, but it is seldom possible or desirable that all research be oriented toward specific jobs. Special coordination is necessary to keep research related to management, especially if the research program and the management activities are in separate administrative units. Such is the case in Kenya, where range management is practiced by the Division of Range Management and range research planned and implemented by the Director of Research.

The tertiary institutions--Egerton and the University of Nairobi have independent boards and are not administratively responsible to either management or research divisions in Government of Kenya. Faculty at these schools, however, have a special opportunity to add to range management knowledge through research and this could go a long way in obtaining important information required for teaching and application to management of rangelands in Kenya. It is strongly urged that support and encouragement be given to this important aspect of range management. We recommend that faculty at the University of Nairobi have at least half their time available for research. In addition, a B.Sc. Honors degree should be introduced that will include a thesis in addition to the coursework.

Research staff may be developed by sending people overseas or developing advanced degrees at the University of Nairobi. We favor both approaches. At the present it may be more efficient to send the

limited number of people that can be employed overseas. In the long run, it will be better to develop post-graduate education in range management in Kenya. As soon as Ph.D. faculty are conducting their own research at the University of Nairobi they should begin a M.Sc. program.

We feel that both the University and the Division of Range Management will benefit if the research in the University is related to problems in the field. Faculty should meet with representatives of the Division periodically to develop a list of researchable problems.

The need for a B.Sc. degree in range management in Kenya is evident. The people obtaining degrees in the United States lack the emphasis on planning, development and administration utilizing the pastoral systems now operating in East Africa. A range management curriculum in Africa must address the effects, both good and bad, that such pastoral nomads as the Somali and Masai have on the land, as well as kinds of land tenure. The socio-economic infra-structure of African range livestock production must be understood in order to know its constraints on range management principles and concepts. This can only be taught in Africa.

CONTINUING EDUCATION

Graduates of all programs should continue to learn even after they have finished their formal schooling. The development of a personal library is a logical first step. Encouragement and opportunity to attend professional conferences is helpful. Reestablishment of the East African Section of the Society for Range Management or the formation of an independent Kenya association of range management professionals is needed to give students an esprit de corps and a place to belong.

Once employed, people should be encouraged to improve themselves and move up the career ladder. There is ample room to grow on the job in Kenya, and good performance is recognized. However, the educational system at present does not allow students from AHITI to go to Egerton or Egerton students to go to the University and receive credit for past training. There are evidences of progression from one school to another, but in all instances, the student must take the entire curriculum.

We strongly recommend the formation of a committee of faculty from each of the three institutions to develop a scheme, acceptable to all, that would allow some credit to be transferred from one to the other.

The range management courses taught at AHITI and Egerton have similar descriptions. Those courses proposed at the University of Nairobi are similar to both. The depth and complexity of coverage at each institution is different, but there is some material common to all. One possible way to give credit for the common material and add to the depth of coverage at higher levels is to give partial credit for the course already taken and require individual study and reporting for the

advanced credit. For instance, an Egerton diplomate could be admitted to the B.Sc. program and be given credit for his Egerton work provided he develops papers and/or oral presentations that show he can relate those courses to problems with the skill normally associated with a B.Sc. graduate. He should then be able to complete a B.Sc. in two years rather than three, or a B.Sc. Honors in three instead of four years.

There are other schemes, such as validation of courses by examination or giving credit for one year (usually the second as now practiced in Tanzania), that can be used. The acceptance and implementation of any scheme depends heavily upon politics in the three institutions. We think it is time that representation of the three schools develop a serious proposal for presentation to their respective governing bodies.

RELATIONSHIP OF RANGE MANAGEMENT TRAINING TO
KENYA'S DEVELOPMENT NEEDS

It is important that graduates of AHITI and Egerton College, and the future graduates in Range Management from the University of Nairobi have education and training that meet the needs of the country. The government needs Range Management Officers in the field who can direct and manage the national program of range and ranch development. It also needs managers for block, group, commercial, individual and company ranches.

In reviewing the range management curricula at AHITI and Egerton College and in developing the B.Sc. curriculum at the University of Nairobi, particular attention has been paid to the kind of training these large development programs require. Still one must realize that circumstances change through time, and a curriculum cannot be constrained entirely by the needs of a program, but rather must be viewed in the context of the kind of education required to produce well-trained people who can adapt to future programs that will emerge in range management.

Several areas were identified which could benefit from increased emphasis in both the AHITI and Egerton range management curricula.

Specifically these are

1. Improve liaison between AHITI and Egerton faculty so that each may know what the other is doing.
2. Increase practical experiences of the student, especially the April-May attachment period for Egerton students. This attachment is not presently as well handled as it might be.

This is certainly an excellent opportunity to enhance the practical

experience the Egerton students now lack. It is recommended that this attachment extend to the other vacation periods as well.

3. Emphasize the economic aspects of livestock production and ranch development, including cost-benefit analysis.
4. Strengthen range management planning providing opportunity for each student to prepare a detailed ranch plan using data provided, where necessary, by the lecturer.
5. Improve and strengthen aspects of range water development whereby students at AHITI are trained to recognize the maintenance needs of water developments. Also vehicle maintenance needs to be stressed.
6. Increase training in accounting procedures as pertains to project management, methods of record keeping and personnel management.
7. Increase training in methods and values of monitoring vegetation change as related to climatic and grazing influences.
8. Place additional emphasis on recognition and appreciation of varying traditions and needs of different pastoral cultures. Efforts to include students from these different cultures in the educational programs should be increased.
9. Augment information given students in livestock-wildlife interactions, competition and complementarity, especially at AHITI.
10. Place more emphasis on sheep and goat production and management at both AHITI and Egerton. Camel production should also be taught as this is a viable industry in Kenya.
11. Provide both schools with a detailed job description, including skills and experience required by the Ministry of Agriculture of Certificate and Diploma holders.

12. Increase attention paid to both sociology and psychology in the training of AHITI and Egerton graduates. Range management is almost as much a social science as it is a biological science.
13. Continue effort to educate other faculty that 80% of Kenya is rangeland and it is an extremely important component of most aspects of both the AHITI and Egerton curricula.

Generally speaking both AHITI and Egerton College have well-designed curricula and course descriptions that address the periodically important issues, concepts and principles. There is evidence that the curricula are thoughtfully reviewed so that the course content keeps pace with the developing needs. The above list is meant as suggestions for improvement in areas perceived to deserve additional emphasis.

The training required of the various kinds of ranching schemes and ownerships differs in each case. The group, company, commercial and individual ranchers require a ranch program that can meet loan requirements and financial commitments. Management of grazing blocks in the NE Province perhaps require less knowledge of financial and economic matters. Since, however, it is not known to which kind of ranch the graduates will ultimately go, it is essential that all are well-grounded in economic principles and livestock marketing with adequate knowledge of fiscal management. All graduates of both schools obviously need to be well trained in the basic principles of range management and ecology.

The needs for technicians and junior range management officers is well supplied by the programs at AHITI and Egerton. Expansion of programs in the Division of Range Management may need more people, but they can be produced with expanded and improved curricula at the certificate and

diploma institutions. However, there are two areas where additional programs are needed: (1) B.Sc. level courses for managers and (2) technical and vocational level courses for range managers and employees.

The justification for the B.Sc. and alternatives for filling the need have been discussed earlier. We support the Head of the Range Management Division in his goal to have his key officers trained to meet the more complex needs.

One area not adequately covered in any curriculum is the training of ranch employees. The people who actually implement the plans will vary in educational background. Some will have adequate training, but many will have no training or qualifications. Shortcourses in elementary accounting, business management, vehicle maintenance, ranching skills, etc. will be needed to assure that the ranchers operate effectively.

Facilities for training these people are often available at Farmer Training Centers throughout the country. However, the staff at these centers are usually not trained in ranching or range management. Faculty from all range management institutions should work with the Division of Range Management's training officer to develop appropriate shortcourses and workshops as needed.

In summary, training will be needed for people of at least four levels of competence if Kenya's rangeland needs are met. These include B.Sc. range managers, diploma level range officers, certificate level technicians, and ranch employees trained for specific skills needed on individual ranches. The diploma and certificate schools are good. If revised and expanded they should meet Kenya's needs. Ranch employee skills can be met by combining the talents of faculty of AHITI and Egerton with facilities at the Farmer Training Centers.

The B.Sc. degree level staff cannot presently be trained in Kenya. A curriculum can be developed at either the University of Nairobi or Egerton College. There are advantages and disadvantages of each school for the proposed B.Sc. program. We feel that the school that can make the changes in its institution most rapidly should have the program.

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APPENDIX I

Principles of Range Management

A Single Service Course for B.Sc. Agriculture

- I. Nature and Scope of Range Management as a Science and Art**
 - A. History of its development**
 - B. Synthesis of disciplines**
 - C. Range management as a discrete body of knowledge**
- II. Role of Range Management in Developing Nations**
 - A. Land tenure and its influence**
 - B. Kinds of livestock enterprises in developing countries such as those in east Africa**
- III. Ecology and Physiology as Related to Range Management**
 - A. Structure and function of rangeland plant communities,**
 - E. African ecosystems overview**
 - B. Influence of grazing animals**
 - 1. Defoliation, preference, palatability, diet**
 - 2. Community change**
 - a. Retrogression, secondary succession, competition**
- IV. Range Sites as Ecological Units**
 - A. Range condition, range trend**
 - B. Methods of determining and monitoring range condition and trend**
 - C. Range sites as related to ecological zones**
- V. Range Management for Livestock Production**
 - A. Relationship of animals numbers to**
 - 1. Animal response**
 - 2. Vegetation response**

B. Nutritive value of range forage by season

C. Role of water and water development

1. Livestock movements

D. Mixed species grazing

1. Cattle, sheep, goats, camels

VI. Range Improvements

A. Bush control and management

1. Mechanical, chemical, biological, burning

B. Fire as an ecological factor

C. Rehabilitation of denuded areas by seeding desirable species

D. Conservation of soil and water

E. Grazing systems for range improvement

1. Deferment

VII. Interrelationships of Climate, Soil, and Grazing

A. Drought and survival requirements

VIII. Livestock and Wildlife Interactions

A. Competition

B. Complementarity

C. Disease

APPENDIX II

The following people were contacted during the preparation of the curriculum review.

Abercrombie, F. USAID, Nairobi
Aboud, A. A., Provincial Range Officer, Northeast Province, Garissa
Ahn, P. M., Soil Science Dept., University of Nairobi
Ayiga, C. S., Head of Range Management Dept., AHITI
Ayuko, L., Head of Range Management, Ministry of Agriculture, Nairobi
Babu, J., Manger, Muengo Ranch, Voi
Baya, Stanley, Range Assist., Kiboko and Alkatar Group Ranches, AHITI grad
Bright, A. H., Assist. Animal Health Officer, Kiboko Range Research Station
Chege, A. M., Coordinator, MOA
Gates, Dillard, USAID, Washington, D.C.
Gota, P. K., Director of Agriculture, MOA
Griffith, Milton, MOA, Nairobi
Gwynne, Michale, Global Environmental Monitoring Service, UNEP, Nairobi
Heller, Rene, Agronomist, Baobab, Farm, Bamburi
Hoffarth, Raoy, USAID, Nairobi
Ibrahim, Kamal, FAO, Kitale
Jones, Bill, USAID, Washington, D.C.
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Kachula, R., Agriculture Finance Corporation, Nairobi
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Karstadt, Lars, Vet. Research Center, Kabete
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Kitivo, A. S., Sheep and Goat Officer, Kiboko Range Research Station
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L'Angat, R., Division of Range Management, MOA, Nairobi
Logogo, Mr., Head, Department of Economics, Egerton
Lutti, J., Lecturer in Range Management, AHITI
Marithi, J., Provincial Ranch Planner, Mombasa

Mbogoh, Henry G., Range Officer, Voi, Coast Province
Mbuvi, David, Assist. Dir. of Ed., Ministry of Tourism & Wildlife, Nairobi
McKell, C. M., Utah State Univ, and FAO, Kitale
Metto, Paul, Lecturer in Range Management, Egerton
Miejiwi, G., Lecturer in Range Management, AHITI
Misiko, P., Head of Agric. Eng., Egerton
Moore, Robert, Evaluation Section, UNEP, Nairobi
Mugambi, J. R., Lecturer in Crop Sci., Univ. of Nairobi
Musangi, Prof. R., Head Animal Production Department, Univ. of Nairobi
Muteti, Johnson M., Range Planner, Kajiado District, Egerton grad
Mwangi, Z., Economist, Division of Range Management, MOA
Mwawuganga, Silas, Voi, AHITI and Egerton grad. Coast Province
Mwova, B., District Range Officer, Voi
Myong, M., Demonstrator, Range Management, AHITI
N'ang'a, S., Demonstrator, Department of Range Management, Egerton
Ng'ethe, J., Lecturer in Botany, Kenyatta University College
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Nzioka, C. S., Principal, Mutuga Training Center
Obwaka, P. T., Principal, Egerton College
Okwirri, J. J., Principal, Eldoret Training Center
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Owanger, F., Lecturer in Range Management, AHITI
Patrick, M., Lecturer, Eldoret Training Center
Purcell, Dennis, Livestock Officer, World Bank
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Weru, S. S., Agr. Engr. Dept., Egerton College
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