

# Range Curricula

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## Introduction

The four-year curricula in Range Management as given at fifteen colleges and universities are reviewed. Statements of the curricula requirements, course titles, credit values, and subject matter outlines for each course solicited from all schools form the basis of this report.

The project was undertaken within the Range Management Education Council as a committee assignment under the Chairmanship of the author with the help of Dr. O. E. Sperry, Texas A. & M. and Dr. E. W. Tisdale, University of Idaho. The first report supplied background information for about eight hours of discussion at the Council meeting, February, 1961 where representatives of twelve schools were present. Later, all the schools submitted written corrections and comments. The revised report as here published incorporates the many suggestions and has Council approval. The questions raised and any stated or inferred educational philosophies are my own and agreement with them by the Council is not implied.

The Council was founded in February 1960, with fourteen voting members, one from each school having a 4-year curriculum in range management. Another joined in 1961. The objectives of the Council are: "To promote high standards in the teaching of range management, to advance the professional ability of range managers, to provide a medium for the exchange of ideas and facts among range management schools, to provide liaison between teaching departments and organizations and agencies in affairs relating to range education and employment standards, and in other ways to foster wider understand-

ing of the problems of range education."

Several points should be kept in mind for a full understanding of the comparisons. First, all quarter credit values have been multiplied by  $\frac{2}{3}$  to put them on a semester basis. Second, all averages have been based on fifteen, the total number of curricula. Third, only one curriculum for each school has been treated. Options have been discussed under a separate heading. Fourth, courses in Physical Education, Military, and graduate instruction have been completely omitted. Fifth, only stipulated courses and restricted elective choices have been included; free electives have been omitted. Sixth, placement exams in English and mathematics and matriculation requirements were not analyzed. Seventh, college and university names have been abbreviated as below to make the text more concise.

Abbreviation	School
Arizona	University of Arizona, Tucson
California	University of California, Berkeley & Davis
Colorado	Colorado State University, Fort Collins
Idaho	University of Idaho, Moscow
M.S.C.	Montana State College, Bozeman
M.S.U.	Montana State University, Missoula
N. Mex.	New Mexico State University, Univ. Park
Nevada	University of Nevada, Reno
Oregon	Oregon State University, Corvallis

So. Dak.	South Dakota State College, Brookings
Texas A. & M.	A. and M. College of Texas, College Station
Texas Tech.	Texas Technological College, Lubbock
Utah	Utah State University, Logan
Washington	Washington State University, Pullman
Wyoming	University of Wyoming, Laramie

Published curricula requirements must be interpreted with care. They are not static and most of them change nearly every year. Students have different interests so in order to retain flexibility and to permit the development of individual programs, a student may petition for changes in his requirements. Every curriculum includes electives, some recommended by the faculty advisor and others left wholly to the student's choice. Thus, the total program for an individual student is only approximately indicated by the listing in this report.

Departures from the norms among the curricula should be interpreted in terms of the local influence of the livestock industry, the importance of other wildland industries, departmental affiliations, and available course offerings in other departments. These effects should continue to temper each curriculum to state and regional needs.

## Natural Sciences

Requirements in the natural sciences include courses in botany, chemistry, geology, physics, zoology and a few others (Table 1).

*Botany:* All schools require courses in general botany, plant physiology, plant ecology, and taxonomy for an average of 14.82 semester credits. Variations in course titles and unit values occur, but on the whole the bot-

**Table 1. Course titles and semester credits in the natural sciences required in the range management curricula at fifteen colleges and universities, 1960.**

Botany								
	Basic		Plant Physiology		Plant Ecology		Taxonomy	
Arizona	General	4.00	Pl. Functions	4.00	Plant Ecology	4.00	Systematic Bot.	4.00
California	General	5.00	Introduction	4.00	Plant Ecology	3.00	Syst. Bot. of Fl. Plts.	4.00
Colorado	Seed Plants	6.67	Plant Phys.	3.33	Plant Ecology	3.33	Plant Classif.	3.33
Idaho	Principles	4.00	Plant Phys.	3.00	Plant Ecology	3.00	Systematic Bot.	4.00
M. S. C.	General	3.33	Plant Phys.	3.33	Plant Ecology	3.33	General	2.67
M. S. U.	Forest Botany	5.33	Plant Phys.	3.33	Plant Ecology	3.33	Local Flora	2.00
N. Mex.	Plant Biology	4.00	Plant Phys.	4.00	Principles	4.00	Plant Tax.	3.00
Nevada	General	3.00	Plant Phys.	4.00	Plant Ecology	4.00	Taxonomy	4.00
Oregon	General	6.00	Principles	2.67	Principles	2.67	Systematic Bot.	2.67
So. Dak.	General	5.33	General	3.33	Plant Ecology	5.33	Tax. Forbs & Shrubs	3.33
Texas A. & M.	General	3.00	Introduction	3.00	Plant & Range	3.00	Taxonomy	3.00
					(in R.M.)			
Texas Tech.	General	3.00	Plant Phys.	3.00	Biocology	3.00	Taxonomy	3.00
Utah	General	6.67	Plant Phys.	3.33	Plant Ecol.	3.33	Taxonomy	3.33
					(in R.M.)			
Washington	Introduction	6.00	Plant Phys.	3.00	Autec. & Synec.	6.00	Systematic Bot.	3.00
Wyoming	General	4.00	Plant Phys.	3.00	Ecology <sup>1</sup>	3.00	Tax. of Vas. Plants <sup>1</sup>	3.00
Mean		4.62		3.36		3.62		3.22
Chemistry								
	Inorganic		Organic		Geology		Physics	
Arizona	Inorganic	5.00	Organic	5.00	Physical	4.00		
California	Inorganic <sup>2</sup>	5.00	Organic	3.00			General	6.00
Colorado	Inorganic	6.67	Organic	5.33	General	3.33	Physics	3.33
Idaho	General	8.00	Carbon compounds	3.00	Physical	4.00	General	4.00
M. S. C.	General	5.33	Organic	3.33	General	3.33	Principles	4.00
M. S. U.	General	5.33	Organic	3.33			General	3.33
N. Mex.	General	8.00	Organic	4.00	Fundamental	4.00		
Nevada	Inorganic	6.00	Organic	4.00			Introduction	4.00
Oregon	General	6.00	Org. & Biochem.	3.33	Physical	2.00	Physics	5.33
So. Dak.	Inorganic	8.00	Organic	3.33				
Texas A. & M.	General	8.00	Organic	3.00	Agr. Geol.	4.00		
	Quant. Analysis	3.00						
Texas Tech.	General	8.00	Organic	4.00				
Utah	Inorganic	6.67	Organic	3.33	Physical	3.33	General	3.00
Washington	General	8.00	Organic	4.00	Introduction	4.00		
Wyoming	General	5.00	Organic	4.00				
Mean		6.80		3.73		2.13		2.20
Zoology								
	Basic		Animal Ecology		Other Natural Sciences			
Arizona	General	4.00						
California	General	8.00						
Colorado	Introduction	3.33						
Idaho	General	4.00						
M. S. C.	Principles	3.33			Genetics			2.00
M. S. U.	General	3.33						
N. Mex.	Animal Biology	4.00			Genetics			3.00
Nevada	General	4.00	Ecol. of Mammals or Mammaology	3.00				
Oregon	General	3.33			Bact.			2.00
					Genetics			2.00
So. Dak.	General	5.33	Animal Ecol.	2.00	Bact.			3.33
					Ento.			1.33
					Genetics			2.00
Texas A. & M.	Vertebrate	3.00	Animal Ecol.	3.00	Genetics			4.00
Texas Tech.	General	3.00			Bact.			3.00
					Ento.			3.00
					Genetics			4.00

Utah	General	3.33		
Washington				
Wyoming	General	4.00	Genetics	3.00
Mean		3.73	0.53	2.18

<sup>1</sup> Plus 3 additional units in either ecology or taxonomy.

<sup>2</sup> An additional 6 units must be selected from statistics, genetics, botany, chemistry, geology and zoology.

any required is strikingly uniform. The first courses in plant ecology at Texas A. & M. and Utah are arbitrarily listed in Table 1 even though they are given by the range management staff. Likewise the listing of all courses in agrostology and range plants is under the "Range Management" heading regardless of the department teaching them.

**Chemistry:** All schools require one or two courses in general or inorganic chemistry for an average unit value of 6.80 and one course in organic chemistry averaging 3.73 units. Agricultural biochemistry is included with organic chemistry at Oregon and Texas A. & M. requires a course in quantitative analysis. The chemistry requirement is

rather uniform and averages 10.53 units.

**Geology:** Nine schools require a course in geology and the average unit value is 2.13. At California the requirement is 6 units of soil science and geology and most students take a course in geology. The course titles include General, Physical, Agricultural, Introduction, and Fundamental Geology.

**Physics:** Eight schools require physics for an average of 2.20 credits. Arizona, N. Mex., South Dakota, Texas A. & M., Texas Tech., Washington, and Wyoming do not require Physics. California requires two courses.

**Zoology and Animal Ecology:** An introductory course or courses, California 8 units, is re-

quired by fourteen of the fifteen schools. The average value is 3.73 credits. Washington does not require a basic zoology course. Animal ecology is required by three schools but at one it is listed as an alternative with Mammology. Washington requires a course in wildlife management, so no curriculum is without work in zoology.

**Other Natural Sciences:** Three other natural sciences are included in the requirements for an average of 2.18 credits per school. These are Genetics at seven schools, Bacteriology at Oregon, So. Dak., and Texas Tech. and Entomology at the latter two.

### Mathematics and Engineering

**Mathematics:** All schools ex-

**Table 2. Course titles and semester credits in mathematics and engineering required in the range management curricula at fifteen colleges and universities, 1960.**

	Mathematics				Engineering			
	Basic		Statistics		Drafting		Surveying	
Arizona	Algebra & Trig.	5.00			Eng. Drawing	3.00	Elements	3.00
California	<sup>1</sup>		<sup>2</sup>				Surveying	3.00
Colorado	Algebra & Trig.	6.67			Map drafting & Reading	1.33	Elements	2.67
							Topographic (camp)	2.00
Idaho	Fundamentals	8.00	Elem. For. Biom. (For.)	3.00	Eng. Graphics	2.00	Elements	3.00
M. S. C.	Intro. Col. Math.	3.33	Elementary	2.67			Conservation Eng. (Agr. Eng.)	2.00
M. S. U.	Trig.	3.33	For. Mensuration	2.67	Mapping (For.)	1.33	Surveying (For.)	6.00
N. Mex.	Math. for Agr. Stu.	3.00					Agr. Surveying (Agr. Eng.)	2.00
Nevada	Algebra & Trig.	4.00	Stat. (Agr. Econ.)	3.00			Surveying	3.00
Oregon	Intermed. Alg. & Trig.	5.33	Basic Tech. (Stat.)	2.00			Forest Eng. (For.)	2.00
So. Dak.	Algebra & Trig.	6.67	Stat. Meth. (Econ.)	3.33			Topographic	2.00
Texas A. & M.	Algebra & Trig.	6.00						
Texas Tech.	Algebra	3.00						
Utah	Algebra & Trig.	7.33					Surveying & Land Mapping	2.00
Washington	Intermed. Alg. & Trig.	8.00					Plane	3.00
Wyoming	Elem. Analyses	5.00			Eng. Drawing	3.00	Conser. & Surveying (Agr. Eng.)	3.00
Mean		4.98		1.11		0.71		2.58

<sup>1</sup> Three years high school math. required or it is made up without credit.

<sup>2</sup> An additional 6 units must be selected from statistics, genetics, botany, chemistry, geology and zoology.

**Table 3. Course titles and semester credits in English and social sciences required in the range management curricula at fifteen colleges and universities, 1960.**

	English							
	Composition		Speech		Writing		Other	
Arizona	Composition	6.00	Principles	3.00				
California	Comp. or Speech	6.00						
Colorado	Composition	4.00	Public speaking	2.00	Tech writing	2.00		
Idaho	Composition	6.00	Speech	2.00	Tech. writing	3.00		
M. S. C.	Oral & Written Communi.	2.67	Same	2.67	Same	2.67		
M. S. U.	Composition	6.00	Speech	4.00	Journalism	2.00		
N. Mex.	Composition	6.00	Public speaking	2.00	Communi. in Agr.	2.00	Engl. elective	3.00
							Library use	1.00
Nevada	Composition	6.00	Speech	2.00				
Oregon	Composition	6.00	Extempore speak.	2.00	Tech writing	2.00		
So. Dak.	Composition	6.00	Oral Communi.	2.67	Writing elect.	2.00		
Texas A. & M.	Comp. & Rhetoric	6.00	Speech	2.00	Writing or Journalism	5.00	Comp. & Lit.	2.00
Texas Tech.	Rhetoric	6.00			Tech. writing	3.00		
Utah	Composition	3.00	Communication	3.00	Adv. writing	2.00		
Washington	Composition	6.00	Speech	2.00	Writing	3.00		
Wyoming	Composition	6.00	Public speaking	2.00	Journalism	2.00	Elective	2.00
Mean		5.44		2.09		2.04		0.53
	Economics							
	Basic		Agricultural, etc.		History and Gov't.		Other Social Sciences	
Arizona	Principles	3.00	Farm & Ranch Mangt.	3.00			Human Relations Electives	3.00
California	Principles	3.00			Examination required		Electives	6.00
Colorado	Intro. and Econ.	4.00						9.00
Idaho	Principles	6.00	Econ. of conserv.	2.00			Electives	6.00
M. S. C.	The Am. Econ.	2.00	Social Sci. in Agr.	3.33				
M. S. U.	Principles	4.00	Forest Economics	3.33			Psychology Electives	3.33
N. Mex.	Introduction	3.00	Ranch & Land Econ.	6.00				2.00
Nevada	Survey of Econ.	3.00	General Agr. Econ.	3.00	U.S. & Nev. History & Const.	2.00	Electives	5.00
			Farm & Ranch Mangt. or Land Econ.	3.00				
Oregon	Principles	6.00	Agr. Land Econ.	2.00	Am. Gov't.	2.00		
So. Dak.	Principles	4.00	Farm & Ranch Mangt.	2.00	Natl. or State Gov't.	2.67	Sociology Electives	3.33
Texas A. & M.	Principles	3.00	Land Economics	3.00	U.S. Hist. & Am. Gov't.	9.00		6.00
Texas Tech.	Fund. Ag. Econ.	3.00	Range & Ranch Econ.	3.00	Am. Gov't.	6.00	Am. Heritage (Hist.)	6.00
			Marketing Agr. Prod.	3.00				
Utah	Principles	3.33					Electives	2.00
Washington	Principles	4.00	Farm & Ranch Mangt.	3.00			Electives	8.00
Wyoming	Pr. Agric. Econ.	3.00	Appld. Econ. to Agr.	2.00	U.S. & Wyom. Gov't.	3.00		
Mean		3.62		2.77		1.64		3.98

cept one require mathematics for an average credit value of 4.98 (Table 2). These are mostly courses in algebra and trigonometry but titles like Introductory College Mathematics, Fundamentals of Mathematics and Mathematics for Agriculture Students occur. At California, the exception, three years of high school mathematics are required for matriculation and students are expected to be ready for calculus or to take preparatory courses outside curriculum requirements. Students at several schools are placed in mathematics courses according to their scores on matriculation examinations.

Six schools require a course in statistics and on a basis of fifteen this amounts to an average of 1.11 units. The courses are given in Departments of Mathematics, Forestry, Agricultural Economics, and Agronomy.

*Surveying and Drafting:* The average requirement is 3.29 units but the range is from none at Utah and So. Dakota to 7.33 at M.S.U. (Table 2). Five of the schools which require surveying also require drafting. Plane, Topographic, and Elements of Surveying are probably given in Engineering Departments and signify fairly standard content. Titles like: Conservation Engineering, Field Practice, Surveying and Mapping courses in Forestry, Conservation and Surveying, Agricultural Surveying, and Forest Engineering are more difficult to interpret. Colorado, Washington, and M.S.U. also require forestry courses in photogrammetry and it is a recommended subject at Arizona. This much variation in the surveying and mapping requirement is difficult to justify. It may reflect a trend toward dependency on engineers for engineering in land management. Suitable courses may not be available unless certain prerequisite courses are taken and there may be other reasons. Work with aerial photos

would seem to be of real value for range students.

#### **English and Social Sciences**

*English Composition, Speech, and Writing:* The average English requirement is 10.10 units with a range of 6 in two courses to 15 in five courses (Table 3). Every school requires composition although the requirement at California is written "composition or speech". The beginning student at many schools takes an entrance examination in English composition, and if he fails, he must pass a make-up course without credit before he can start the English requirement. Thirteen schools require a course in speech and eleven a course in technical writing or journalism. Other English courses are required at three schools.

*Economics:* The average unit requirement is 6.39 with variation between 3 and 9 units. The first course may be in an Economics or Agricultural Economics Department and may be labeled Principles, Introduction, Survey, or as at M.S.C., Social Science in Agriculture or The American Economy. Eight schools require Farm and Ranch Management, Land Economics, or a combination of these subjects. Economics of Conservation appears as a title at Idaho and Applied Economics to Agriculture at Wyoming. Ten schools require two courses, three ask for one course, and two schools require three courses.

*History, National and State Government:* These subjects are required by five schools for an average of 1.64 credits on the basis of fifteen. California has a History and Government requirement that can be met by course credit at Davis and by examination only at Berkeley. This type of requirement is stipulated by the university rather than by the Range Curriculum. Nevada, Wyoming, and perhaps others have similar university requirements.

*Other Social Sciences:* The average requirement is 3.98 credits but only nine schools specify a certain number of units in these subject matters. Psychology and Sociology are required mostly as restricted electives. Four schools require 8 or 9 units and the others include 2 to 6. Courses in social sciences are recommended electives at other schools.

#### **Agriculture**

*Orientation:* Twelve curricula require a course in orientation with an average credit value of 1.16 (Table 4). The course names include Agriculture Orientation; Forestry Lectures; Introduction to Range and Forestry; Vocations in Agriculture; Elements of Forestry, Range, and Wildlife; Survey of Forestry; General Forestry; and Forestry and Allied Professions.

*Agronomy:* Elements of Agronomy, Crop Production, Field Crops, Farm Crops, Plant Industry, and Plant Science in Agriculture are titles of the introductory material in Agronomy required by nine schools. The average on a basis of fifteen is 2.53 credits. Forage crops or Forage and Pasture Crops is required by seven schools and the average is 1.31 credits. One other agronomy course is required: Weed Control, at Arizona. The average agronomy requirement is 3.84 units. M.S.U., Utah, and Washington do not require work in agronomy.

*Animal Husbandry:* The average animal husbandry requirement is 9.84 credits with a range from 5 to 15 credits. Every school requires at least two courses. Livestock nutrition or feeds and feeding or both is required by all schools with an average value of 3.38 credits. The other credits are about half in an introductory course, livestock judging included, and half in one or two courses which emphasize management and production. Wyoming includes 3 credits in Poultry or Dairy. Anatomy and Phys-

**Table 4. Course titles and semester credits in agriculture required in the range management curricula at fifteen colleges and universities, 1960.**

			Agronomy		
Orientation			Basic	Forage Crops	
Arizona	Vocations in Agric.	1.00	Plant Industry Weed control	3.00 3.00	Forage & Past. Crops 3.00
California					Forage Crops 3.00
Colorado	For. & Allied Prof.	1.33			Forage Crops 2.67
Idaho	Forestry Lectures	2.00			Forage Crops <sup>1</sup> 3.00
M. S. C.	Agr. Orient.	0.67	Plant Sci. in Agr.	3.33	
M. S. U.	Survey of For.	2.00			
N. Mex.			Farm Crops	4.00	
Nevada	Orientation	1.00	Intro. to Plant Sci.	3.00	Forage Crops 3.00
Oregon			Elements	3.33	
So. Dak.	Orientation	0.67	Crop Production	3.33	Pasture Mangt. 2.00
Texas A. & M.	Intro. Range & For.	1.00	Fund. Crop Prod.	3.00	
Texas Tech.	Orientation	1.00	Fundamentals	3.00	Forage & Past. Crops 3.00
			Plant Breeding	3.00	
Utah	Elements For., Range, Wildlife	2.67			
Washington	Gen. Forestry	3.00			
Wyoming	Agr. Orient.	1.00	Field Crops	6.00	
Mean		1.16		2.53	1.31
Animal Husbandry					
Basic			Nutrition, Feeds & Feeding		Production
Arizona	Animal Industry	4.00	Feeding Livestock	3.00	Beef Cattle Prod. 3.00
California	Intro. & Types	4.00	Feeds & Feeding	3.00	Meat Prod. 3.00
Colorado			Feeds & Feeding	3.33	Sheep & Beef Prod. 4.00
Idaho	Livestock Industry	3.00	Livestock Feeding	3.00	Beef Cattle Prod. <sup>1</sup> 3.00
M. S. C.	Animal Sci. in Agr.	3.33	Feeds & Feeding	2.67	Sheep & Beef Prod. 5.33
M. S. U.			Range Livestock Nut. (For.)	3.33	Range Livestock Prod. (For.) 2.00
N. Mex.	Introduction	3.00	Princ. of Feeding	4.00	Beef or Sheep Prod. 4.00
	Physiol. Farm Anim.	3.00			
Nevada	Elements	3.00	Animal Nutrition	3.00	Elective 4.00
Oregon	Intro. Dairy & Ani. Sci.	2.00	Animal Nutrition	2.67	Beef Cattle Hus. 2.00
So. Dak.	Introduction	2.67	Livestock Nutrition	2.00	Beef & Sheep Prod. 5.33
			Livestock Feeding	2.67	
Texas A. & M.	General	3.00	Animal Nutrition	3.00	Livestock Mangt. 3.00
Texas Tech.	General	3.00	Ani. Nut. & Pr. Feeding	3.00	Beef & Sheep Prod. 6.00
	Anatomy Farm Animals	3.00			
Utah	Judging	1.33	Nutrition, Feeds & Feeding	6.00	Beef & Sheep Prod. 4.00
Washington	Animal Science	3.00	Nutrition	2.00	
Wyoming	Intro. & Poultry or Dairy	7.00	Feeding	4.00	
Mean		3.22		3.38	3.24
			Soil Science		Other Agr.
Basic			Other		
Arizona	Soils	3.00			
California	Soil Sci. <sup>2</sup>	6.00			
Colorado	Soils	4.00	Fertility	3.33	
			Classification	2.33	
			For. & Range soils	2.67	
Idaho	General	3.00			
M. S. C.	General	2.67	Classif. & Sur.	2.00	
M. S. U.	Soils (For.)	2.67			
N. Mex.	Soils	4.00			
Nevada	General	3.00	Genesis & Classif.	4.00	Seminar 1.00
Oregon	Soils	4.00	Soil Survey	2.67	
So. Dak.	Soils	4.00	Classif. & Genesis	2.00	
Texas A. & M.	Introduction	4.00	Morphology	2.00	

Texas Tech.	Soils	4.00	Morph. & Genesis	3.00	Pr. Dairying	3.00
			Soil Fertility	3.00	Pr. Hort.	3.00
					Seminar	1.00
Utah	General	3.33				
Washington	Soils	4.00				
Wyoming	Soils	3.00			Farm Power & Mach.	4.00
Mean		3.64		1.80		0.94

<sup>1</sup>Other courses in same subject matter field substituted with permission.

<sup>2</sup>Or 3 units of soils and 3 units of geology.

iology of Farm Animals is required by New Mexico and Texas Tech. All the courses are given in animal husbandry departments except those at M.S.U., where two courses are given in the Forestry School.

**Soil Science:** All schools require a basic course in soils and its average credit value is 3.64. Seven schools require additional work in soils for an average of 1.80 credits. These titles include Classification and Survey, Morphology, Genesis, Fertility, and Forestry and Range Soils. Colorado requires 12.33 credits and Texas Tech. 10.00 credits.

**Other Agriculture:** Principles of Dairying and Principles of Horticulture are in the Range Curriculum at Texas Tech. This school and Nevada require a general Seminar and Wyoming includes a course on Farm Power and Machinery. These total 12 credits and average 0.94 credits for the fifteen schools.

#### Wildland Uses Other Than Range

**Forestry:** The requirements in Forestry are so varied that the average credits value of 4.49 has little value (Table 5). Eight schools do not require Forestry. Oregon and South Dakota require 2 credits, Washington 5, Texas A. & M. 6, Colorado 9.33, Idaho 13, and M. S. U. 30 credits. These do not express the whole picture because other options are usually available where curricula in range management and forestry are in the same administrative unit. For example, at M. S. U. students would take less forestry if they selected the curriculum in Forest Conservation.

The forestry requirement in a different curriculum at Utah is 20 units and Arizona offers options which combine Range Management with several other subjects.

**Soil Conservation and Watershed Management:** Separate courses in these subjects are required by seven schools for an average of 1.78 credits on a basis of fifteen schools. Two of the seven schools require courses in both subjects. New Mexico and Texas Tech. include a conservation course only. The work in soil conservation is given by Departments of Agricultural Chemistry, Forestry, Agricultural Engineering, and Agronomy. The Watershed courses are in Forestry. Presumably most schools have some work on watershed management as it was specifically mentioned in the outlines of several Range Management courses. On the other hand, specific work on watersheds was not mentioned in course outlines or as separate courses at California, Oregon, Texas A. & M., and Wyoming.

**Wildlife Management:** Twelve schools require Wildlife Management with an average of 2.33 credits. Prerequisites in zoology include a basic course at all schools, Washington excepted, and animal ecology at Nevada, So. Dak., and Texas A. & M. Most students at California take work in Wildlife Management as a part of a group requirement.

**Multiple Use:** Wildlands are commonly considered to have one or more of five groups of uses; for forage, timber, water, wildlife, and recreation. One curriculum, Colorado's, includes

courses in all five, when a summer camp course with "Recreation" in the title is considered. Forestry, Wildlife and Watershed courses are included at Arizona, Idaho, M.S.U., Texas A. & M., and Utah if the orientation courses which include forestry are considered. Courses in Wildlife and Forestry are in the curricula at Oregon, South Dakota and Washington. Watershed and Wildlife are in the curricula at N. Mex. and Texas Tech. Wildlife or Animal Ecology is included at M.S.C., New Mexico, and Nevada. No specific courses in Forestry, Wildlife, Watershed and Recreation are required at California and Wyoming.

Range Management courses which attempt to cover several of these uses in an integrated fashion are in the curricula at Colorado, Idaho, M.S.C., M.S.U., Nevada, and Washington. These courses vary in title, including Land Use Seminar, Range Planning, Resource Management, and Policy and Administration. Other courses include a chapter on multiple use and the Seminars may be on the subject. The course outlines from Wyoming were the only ones that made no mention of any multiple use aspect outside of Range Management.

The breadth and intensity of training and the degree to which all the wildland uses are integrated into land planning are not clear from the course descriptions received. Multiple use concepts may be incorporated throughout the training, as they should be in light of recent trends in the multiple use of wildlands.

**Table 5. Course titles and semester credits in other wildland uses required in the range management curricula at fifteen colleges and universities, 1960.**

Forestry			Soil Conservation		Watershed Mangt.		Wildlife Mangt.	
Arizona			Soil Cons. (Agr. Chem.)	3.00	Watershed Mangt.	2.00	Wildlife Cons.	2.00
California							1	
Colorado	Conservation	2.00	Soil Cons. Practice	3.33	Pr. Watershed		Principles	2.00
	Fire Control	2.00			Mangt.	2.00	Forestry camp	2.00
	Photogrammetry	1.33			Forestry camp	2.00		
	Forestry camp	4.00						
Idaho	Silvics & Silvicul.	5.00			Watershed Mangt.	3.00	Principles (For.)	3.00
	Field							
	Measurement	4.00						
	Field Ecol. (Camp)	4.00						
M. S. C.							Principles	2.00
M. S. U.	Forestry	30.00			Watershed Mangt. <sup>2</sup>	2.67	Wildlife Mangt.	2.67
N. Mex.			Soil & Water Cons.	3.00			Principles	3.00
Nevada								
Oregon	Farm Forestry	2.00					Wildlife Mangt.	4.00
So. Dak.	Elective	2.00					Wildlife Mangt.	2.00
Texas A. & M.	Farm For.	3.00					Wildlife Cons. & Mangt.	3.00
	Silvics & Silvicul.	3.00						
Texas Tech.			Soil Cons. & Land Plan.	3.00			Wildlife Mangt.	3.00
Utah					Watershed Mangt.	2.67	Wildlife Mangt.	3.33
Washington	Airphoto Interp.	2.00					Wildlife Mangt.	3.00
	Silviculture	3.00						
Wyoming								
Mean		4.49		0.82		0.96		2.33

<sup>1</sup>An additional 6 units must be selected from statistics, botany, chemistry, geology and zoology.

<sup>2</sup>Or Big Game Mangt.

### Range Management

Range Management requirements were difficult to analyze because (1) the subject matter is packaged differently in the different curricula; (2) various names are used; (3) certain blocks of subject matter are given in range in some schools but in other departments at other schools; (4) intensity of coverage varies tremendously; and (5) local range situations and administrative affiliations cause differences in emphasis. No doubt personal beliefs and training of the teachers play a part in making these curricula different and in my assessment of them. This factor is left completely to the reader's evaluation. Decisions of arrangement

had to be made and after several attempts the following main blocks of material were at least partially evident:

1. Emphasis on plants including agrostology, range plants, range ecology.
2. Emphasis on techniques, surveys, mapping, utilization, condition, trend.
3. Emphasis on management, improvements, planning, economics, policy.
4. Seminar.
5. Field trips and camps.

Many courses overlapped these divisions and their placement was determined by the major emphasis in the course and in the whole curriculum. For example, methodology was widely scattered and courses listed

under techniques were not necessarily all methods. About 90 percent of the average range requirements were included in the first three headings and all curricula have courses listed therein (Table 6).

*Emphasis on plants:* The average requirement in agrostology, forage plants and range ecology is 6.80 units. Nine schools place this material in two courses. Texas Tech. does it in one and five schools have three courses or more. The course in agrostology is given in Botany at Colorado, Idaho, M.S.C., M.S.U, Oregon, South Dakota, Utah, and Washington. Two other special courses are required; Woody Plants at Colorado and Poisonous Plants at Nevada.



**Table 6. Course titles and semester credits in range management required in the curricula at fifteen colleges and universities, 1960.**

	Agrostology, range plants, range ecology		Methods, utilization, condition & trend	Management, improvements, planning, economics, policy		Seminar	Field trip	Total credits
Arizona	R. Forage Plants	4.00	R. Forage Evaluation	R. Management	3.00	R. Seminar 1.00	R. Field Studies 3.00	21.00
	R. Ecology	4.00						
	R. Resources	3.00	3.00					
California	R. Plants	3.00	R. Inventory and Analysis	Introduction to R.M.	3.00		Field Practice (4 weeks)	12.00
	Grassland Ecology	3.00	3.00				0	
Colorado	Ident. of Grasses (Bot.)	2.00	R. Analysis and Mangt.	Principles R.M.	2.00		Forestry Camp	
	Woody Plants (For.)	2.00	Plans 4.00	R. Revegetation	2.00			
	R. Forage Plants	2.67	R. Utilization	R. Policy	1.33			
	R. Ecology	3.00	3.33	R. Economics	2.00		10.00	24.33 <sup>1</sup>
Idaho	Agrostology (Bot.)	3.00	R. Methods & Tech.	Elements R.M.	3.00	Land Mangt.	Forestry Camp	
	R. Plants	3.00	3.00	R. M. Planning	3.00	1.00	10.00	16.00 <sup>1</sup>
M. S. C.	Agrostology (Bot.)	2.67	Range Surveys	R.M. Practices	3.33	Seminar	R. Inspection trip	
	Forage Values of R. Plants	2.00	4.00	R. Renovation Practices	2.67	0.67	0.67	24.67
	Ranges & R. Plants	2.00		R.M. Planning	2.00			
	Grazing Influences & Practices	2.67		R. Policy & Adm.	2.00			
M. S. U.	Agrostology (Bot.)	3.33	R. Techniques	General R.M.	3.33		Regional R.M.	
	R. Forage Plants	2.67	2.67	R. Administration	1.33		4.00	19.33
				R. Economics	2.00			
N. Mex.	R. Grasses	3.00	Adv. R.	R. Management	4.00	R.M. Seminar	R.M. Camp	
	R. Botany	3.00	Mangt. 4.00			1.00		
	R. Ecology	4.00					5.00	24.00
Nevada	R. Agrostology	3.00	R. Study Tech.	R. & Pasture Mangt.	3.00	R. and Pasture Lit.	Field trip	
	R. Plants	1.00	2.00	R. Improvement	1.00	1.00	2.00	16.00
	Poisonous Plants	1.00		Grazing Influences	1.00			
				R. Administration	1.00			
Oregon	Agrostology (Bot.)	2.00	R. Methods	R. Management	2.00	R. Management		
	Range Plants	2.00	3.33	R. Improvement	2.00	2.00		15.33
				R.M. Planning	2.00			
So. Dak.	Agrostology (Bot.)	2.67	Range Surveys	Principles R.M.	3.33	R. Seminar	Field Studies in	
	Ranges & R. Plants	2.00	2.67	R. Improvements	2.00	0.67	R.M. 2.00	17.33
				R. M. Plans	2.00			
Texas A. & M.	Agrostology	3.00	R. Techniques	R. Management	3.00		Summer Field Experience	
	Range Plants	3.00	3.00	Adv. R. Mangt.	3.00		3.00	18.00
Texas Tech.	R. Plants	3.00	R. M. Problems	R. Plant Mangt.	3.00			
			3.00	Adv. R. Plant Mangt.	3.00			12.00
Utah	Agrostology (Bot.)	2.67	Tech. Problems	Principles Mangt.	3.33	R. Seminar	R. Field Problems	
	R. Plant Communities	6.67	R. Analysis Tech.	R. Improvement	2.00	4.00	2.00	25.33
			0.67	R. Economics	2.00			
Washington	Agrostology (Bot.)	3.00	Range	R. Management	3.00	Land Use		15.00
	R. Forage Plants	3.00	Analy. 2.00	R. Livestock Mangt.	3.00	1.00		
Wyoming	R. Plants—Grasses	3.00	R. Surveys	R. Utilization and Improvement	3.00	Seminar		
	R. Plants—Others	3.00	3.00		2.00			14.00
Mean		6.80	3.24		5.85	0.96	1.44	18.29

<sup>1</sup> Credits for Forestry Summer Camp omitted.

The material presented varies a great deal. Emphasis may be primarily taxonomic or perhaps largely sight recognition based on herbarium mounts and local flora. Some apparently give more consideration to the management and ecological aspect of the vegetation. Generally the individual species is the center of focus and such items as distribution, forage value, management problems and practices, indicator values, nutritive qualities, palatability, phenology, growth habits, associated species, habitat and climatic limitations, reactions to grazings, season of use, and successional status are mentioned. The major forage species receive primary emphasis and unpalatable, poisonous, mechanically injurious, and invading species are often included, but are not always mentioned. The course at Wyoming includes consideration of fossil records, evolution, and shifting floras. M.S.C. includes a course that emphasizes nutrition, chemical components, and animal diets. The average number of species studied probably is in excess of 150 although this is by no means clear. The plants in the Range Society contest may be the basic list of species which is modified with local plants even though no course description mentioned it. A critical analysis of the influence of the contest on course contents in schools which enter and which do not enter teams would be interesting and could show the way to a better contest.

Several course descriptions mentioned that the plants were grouped regionally rather than taxonomically. This indicates an emphasis on vegetational types or regions, ecological considerations, regional management problems, and practices. This gives the reason for including range ecology with the material that emphasizes individual plants.

The first course in ecology is listed with botany even though

it is given by the range staff at Texas A. & M. and Utah. Seven schools give additional work in range ecology. The names include Ranges and Range Plants, Grazing Influences and Practices, Range Resources, Grassland Ecology, and Range Plant communities. The most common subject matter thread through these is the range type. As many as 20 or more types are described according to species, distribution, soil, environment, vegetational changes, livestock industry, management problems and practices, and range improvements. In short the subject matter concerns the plant community and its management. Of interest is that Ranges and Range Plants at M.S.C. and South Da-

kota, Range Resources at Arizona and Grassland Ecology at California are almost from the same mold. Utah covers this subject matter in three courses: Grassland Communities, Forest Communities, and Desert Communities.

As with the other major blocks of range subject matter there is much variation in arrangement. All those schools which do not teach range ecology under a separate heading have a liberal sprinkling of community and ecosystem ecology through the management and techniques courses. This is also true, but probably to a lesser degree, for those schools with courses in range ecology.

The environmental factor, in-

**Table 7. The Average Range Management Curriculum.**

	Average semester Credit requirement	
Natural Sciences		35.98
Botany (Basic*, Physiology*, Taxonomy*, Ecology*)	14.82	
Chemistry (Inorganic*, organic*)	10.53	
Geology	2.13	
Physics	2.20	
Zoology (Basic, Animal Ecology)	4.26	
Others (Genetics, Entomology, Bacteriology)	2.18	
Mathematics and Engineering		9.38
Mathematics (Algebra*, Trigonometry*)	4.98	
Statistics	1.11	
Engineering (Drafting, Surveying)	3.29	
English and Social Sciences		22.11
English (Composition*, Speech, Writing, others)	10.10	
Economics (Basic*, Agricultural)	6.39	
Social Sciences, History & Government	5.62	
Agriculture		21.22
Orientation	1.16	
Agronomy (Elements, Forage crops)	3.84	
Animal Husbandry (Basic and Production*, Nutrition and Feeds*)	9.84	
Soil science (Basic*, others)	5.44	
Others	0.94	
Other Wildland Uses		8.60
Forestry	4.49	
Watershed Management, Soil Conservation	1.78	
Wildlife Management	2.33	
Range Management		18.29
*Agrostology, Range Plants, Range Ecology	6.80	
*Methods, Utilization, Condition and Trend	3.24	
*Management, Improvements, Planning, Economics, Policy	5.85	
Seminar	0.96	
Field Trip	1.44	
Total		115.58

\*Subjects required in all curricula.

dividual plant, or autecological approach is evident in some courses and the "influence" approach in others. By the latter is meant the influence of grazing on plants, vegetation, and soil. This material is similar to that given in Range Utilization. Arizona combines an analysis of the principal factors affecting range and their application to range management under the name "Range Ecology." Nevada includes discussion of grassland communities, climate, and response to herbage removal in agrostology. How widespread is the coverage of environmental factors, instrumentation, and meteorology is not clear.

Standardizing these courses is undesirable but there does seem to be need for a statement of minimum requirements. What is a reasonable number of plants with which the student should be familiar? How many undesirable plants should be studied? How well should the faculty to use keys be developed? How much factual knowledge about range plant species and plant communities is needed by the range graduate? What is a reasonable balance of taxonomic, ecological and management information on ranges and range plants? These questions illustrate the degree to which the Range Management Education Council and hiring agencies might want to define an academic straight-jacket. The last question is the important one.

*Emphasis on Methods, Utilization, Condition, and Trend:* In all schools a course with emphasis on techniques, analysis, methods, surveys, range forage evaluation or technical problems is given. Utah has two courses. Two approaches to techniques subject matter are evident. One concentrates on range surveys, condition and trend, utilization checks, use factors, mapping, carrying capacity, photogrammetry, and range readiness. The other gives emphasis to research

methods, sampling theory, statistical analysis, and sampling techniques that concentrate on such items as cover, composition, frequency, weight of herbage, and distance measurements. No course separates completely the managerial and the ecological approaches to methods. It is not clear how much methodology is taught in the laboratories of other courses but certainly there is considerable. For example, the courses with "utilization" in the title specifically mentioned use measurements and most courses in range planning start with the student making a range inventory. The course titled "Range Utilization" at Colorado includes material on the effects of animals on plants, preferences, grazing systems, utilization, and range condition. This illustrates the fact that techniques, ecological considerations, and management are combined in many range courses. The average credit value for material listed under this heading is 3.24.

*Management, Improvements, Policy, Economics, Planning:* An average credit value of 5.85 is in courses classified as primarily management. The work is given in one to four courses. Commonly there is a course in principles or even two in which the whole field is covered. In other cases blocks of subject matter on range improvements, range economics, administration and policy, and ranch or range planning are given as separate courses.

At this point a discussion of the introduction to range management seems appropriate. California and Wyoming give a terminal beginning course that is designed primarily for non-majors but it is taken by part of the majors. All majors at M.S.C. and Oregon are required to take the terminal beginning course and Arizona is initiating such a course. Texas has two parallel courses for non-majors. Brief handling of range is included in orientation courses at Arizona,

**Table 8. The 1952 standard range curriculum with an estimate of 1960 compliance.**

- A. Basic courses
  1. *English*, especially writing and grammar. (*grammar 100%, writing 80%*)
  2. *Speech*, (90%)
  3. *Mathematics*, including algebra and trigonometry. (100%)
  4. *Chemistry*, including organic. (100%)
  5. *Economics*, especially agricultural. (100%, *Agricultural 80%*)
- B. Technical courses
  1. *Range Management*, including plants, management, methods, ecology, multiple use, improvements, history, administration and policy, economics and field application. (80 to 90%)
  2. *Animal husbandry*, including feeds and feeding, nutrition, range livestock breeds and judging, management, and production. (95% except judging)
  3. *Zoology*, especially animal ecology. (95%, *Animal Ecology 20%*)
  4. *Soils*, including morphology, classification, fertility, erosion and vegetation influences. (*Principles 100%, others 45%*)
- C. Elective courses
  1. *Forestry*, management, measurement, silviculture, fire control. (45%)
  2. *Wildlife management*, big game, predators, rodents. (80%)
  3. *Zoology*, especially animal ecology. (95%, *Animal Ecology 20%*)
  4. *Geology*. (60%)
  5. *Land surveying and mapping*. (90%)
  6. *Veterinary science*. (Zero)
  7. *Genetics*. (40%)
  8. *Agronomy*, especially forage crops. (60%, *Forage Crops 45%*)

California, Colorado, Idaho, Nevada, Texas A. & M., Utah, and probably others. The extent of this material varies from a few lectures in a course covering many fields to a separate course of about 1 credit.

Five schools treat seeding, undesirable plant control and fertilization in a separate course called Range Improvements. These are M.S.U., Nevada, Oregon, South Dakota, and Utah. M.S.C. calls the course Range Renovation Practices and includes rodent control and government policies on renovation. Colorado includes only seed production, seed testing, seeding practices and machinery under the name Range Revegetation. The variation doesn't end here as the following may or may not be included under range improvements: fencing, stock water, terraces, pitting, water spreading, roads, trails, characteristics of depleted ranges, management system, etc. Wyoming combines range utilization and improvement and mentions only relationships of range plants to soil, water, light, and use by livestock; management practices; digestibility; and grass morphology and laboratory identification.

The courses on management exhibit a great deal of variation but in total they cover the whole management field. "Range Management" by Stoddart and Smith is the text commonly used and numerous course outlines follow it closely although none exactly.

Administration and policy deal with the history of land acquisition, legislation, and federal land policies; the history, organization, functions, land use problems, policies, and personnel of the various federal and state agencies; and the grazing regulations and practices of the agencies. Colorado, M.S.C., M.S.U. and Nevada see these as important enough for a separate course. The other schools treat this subject more briefly in one of the

management courses or perhaps not at all.

Colorado, M.S.U., and Utah have a course in range economics. Subject matter headings in these courses include land valuation, income, costs, tenure, taxation, fees, leases, costs and returns from improvements, ranch organization, land appraisal, credit, marketing, and others. A question is raised concerning the approach to all these subjects. Is it one of description, accounting, and the business of ranching as might be learned in a ranch study? Or is it evaluation of alternatives, and application of economic theory? Or is it an attempt to sell management to students on a dollars and cents basis?

The scope of dollars and cents application in the management courses is not evident in the outlines. The field of range economics from the economist's viewpoint is not well developed and there are precious few range technicians with degrees in economics and vice versa. If we are training professional men, the lack of economics may be the most serious deficiency. If the emphasis is toward biologists perhaps the lack of economics is not so important.

Several schools (Idaho, M.S.C., Oregon, and South Dakota) have a senior finalizing course on range planning. Colorado and New Mexico combine the planning with range analysis. The objective in these courses is to give the student training in making a range inventory and preparing an operating plan. It begins with collection of field data and proceeds through problem definition, consideration of alternative decisions and preparation of a written plan for accomplishment of the management objective. The course seeks to integrate knowledge from the biological, economic, and managerial aspects of range management. This seems to call for top-level professional attainment

and the question is raised: why do not all curricula include training in range planning?

*Seminar:* Ten schools include seminars in their curricula. The subject matter for most of them is multiple use, current problems, or current literature. An advanced range management course at Oregon is included here because it discusses recent advances in range management and is organized on a seminar basis.

*Field Trip.* Eleven schools require a major field tour, summer camp, or summer experience beyond those field trips in the regular session courses. These vary from about a week at M.S.C. and Nevada to 10 weeks of forestry camp at Colorado and Idaho. The credit value varies from none for 4 weeks of work at California to 10 credits for the two forestry camps. The 10 units for those camps were not included in the totals for range management as they were already counted in Forestry. These camps are given as three or four separate courses and the same is true in part for some of the field courses in range management at South Dakota. The other trips are inspection trips where visits are made to ranches, research centers, and to see the various agency action programs. The trip under the title "Regional Range Management" at M.S.U. is one of the oldest courses of this nature and coming late in the senior year, it seeks to integrate all phases of Range Management.

*Subject Matter Sequence:* The sequence of range material begins either with the first management course or one of the plant courses. These are followed by methodology, range ecology, policy and administration, and economics. Usually the field trip is between the junior and senior years, although Colorado has a sophomore camp and M.S.U. has its field tour in the last quarter of the senior year. Second and third courses in spe-

cialized parts of management, such as improvements, revegetation and planning, and the seminar come last. There were a few questionable sequences: At Arizona Systematic Botany came after the course in range plants. The course in Agrostology came late in the program at Washington. Alternating work of the junior and senior years between two campuses causes a switch in order for some students at California. The planning course is in a fall semester senior position and is followed by Renovation Practices, Forage Values of Range Plants and the Seminar at M.S.C.

**Total Range Management Requirements:** The number of required credits in range courses varies from a low of 12 at California and Texas Tech. to a high of 25.33 credits at Utah. The course packages vary between 4 and 11. The average credit requirement in range is 18.29 units. Straight comparisons of these total units between schools is not a strictly fair comparison because the total units required for the degree varies between 124 and 151. The percentages that range management courses compose of the total curricula are as follows:

Utah	19.8
M. S. C.	18.1
Colorado	17.0
N. Mex.	16.7
Arizona	16.1
So. Dak.	13.7
M. S. U.	13.5
Texas A. & M.	12.5
Oregon	12.0
Nevada	11.9
Washington	11.7
Idaho	10.6
Wyoming	10.6
California	9.7
Texas Tech.	8.6

The above percentages show wide variation in the relative intensity of range management instruction. One cause may be that some schools place more emphasis than others on developing facility in doing the vo-

cational types of range jobs. Another may be found in the relative amount of detail used to illustrate range management principles. Whatever the causes, optimum training in range management warrants more uniformity, unless the educational objectives differ among the schools.

#### Options or Majors in Range Management

Nine schools mention two or more options or majors for Range Management. These are as follows: The first named for each school is summarized in the tables and narrative parts of this report and the others are not.

Arizona	Range Management Range—Forestry Range—Wildlife Range—Recreation Range—Animal Science
California	Curriculum in Range Management Option in Forestry curriculum Option in Agricultural Production curriculum
Colorado	Range conservation Forest-Range Management
M. S. C.	Agricultural Production Agricultural Science Agricultural Business
M. S. U.	Forestry with R. M. Forest Conservation with R. M.
Oregon	Agricultural Science Agricultural Technology Agricultural Business
Utah	Range Management Forest-Range Watershed Management
Washington	Technical Range Management Option Science specialization option

#### Range Management option

#### Wyoming Range Management Science option

There seems little point in discussing these options in detail. With few exceptions they include the same range management courses that are in the option summarized for each school. The differences are in the relative emphasis on other subjects such as forestry, phases of agriculture, and business. The names indicate the emphasis. Some options are new and have not been implemented. Some meet the present Civil Service requirements and others do not.

#### The Average Range Management Curriculum

The average curriculum (Table 7) amounts to 115.58 credits. This is a straight listing of averages. Subjects marked with an asterisk were required in all the curricula and amount to 68.76 credits.

A committee of the Society published in 1952 (Jour. Range Mangt. 5:393-394) a "Standard Range Management Curriculum" for the guidance of schools, students and the U. S. Civil Service Commission. Those recommendations are given in Table 8. In that table each subject matter is followed by a percentage figure which is my estimate of the overall attainment of the 1952 listings. The percentages express the proportion of the fifteen curricula that require work in each subject. No single curriculum meets all of these suggestions, especially in the category of "Elective courses." There would seem to be room for improvement in one or more of English (writing and speech), agricultural economics, animal husbandry, soil science, range management, and other wildland uses in all the curricula. No school has found veterinary science important enough to include. On the other hand, several curricula require work in physics, statistics, and social sciences;

subjects not mentioned in the 1952 recommendations.

### Points for Discussion

The objective of this study was to summarize the range curricula so that the Range Management Education Council would have the factual material from which they could arrive at recommendations for (1) a standard range management curriculum, ("standard" is used because the Council has not yet established specifications for a "minimum" or an "ideal" curriculum) and (2) Civil Service requirements in range management. Numerous questions and points will, no doubt, be discussed before these recommendations are written and the Council has made a start in that direction. Opinions from others are welcome and one reason for presenting this paper to the Society members is to solicit comments. A few detailed points of discussion have been suggested, and the following are some larger areas of educational philosophy that are directed to your attention.

Ranges and Range Management are not the same. A range is an ecosystem in which the interaction of vegetation and grazing animals is of primary but not the only concern. Ranges normally include vegetation which is not grazed such as trees and many so-called undesirable plants and other items like streams, lakes, barren land, and engineering developments.

Range Management is the administration and business of managing ranges and other included lands on a scientific basis. It includes the management of all resources of the range including forage, timber, wildlife, water, and recreation. Knowledge of managerial practices for continuous production of all these goods and services is a requirement of professional range managers. So is a knowledge of interrelationships among these resources. It is granted that these are related fields educationally, but they become a part of range management in the management of ranges. Therefore, do the students in range management learn enough about these related fields in the present curricula?

The practice of range management gives due regard to economic and business considerations. Many range problems may best be solved through the applications of economic analysis and techniques used in business administration with respect to operations and decision making. Sorting of alternative practices to obtain the most favorable returns is done on a basis of inputs and outputs within a business structure. Do the curricula adequately train in the area that combines the biological, economic, and business aspects of managing range lands?

A range manager is a person competent to practice the profession. He deals with the application of knowledge. Some are scientists who deal with the ac-

quisition of knowledge. A few range students want to become competent ranch operators. Other are called upon to do many vocational tasks like locating water developments, building dams, seeding ranges, and many more. Where do graduates of these fifteen curricula fit into this scale? Are they semi-professional, with a solid foundation on which they can grow to meet increased administrative and business responsibilities? Are they well grounded in the mechanics of doing a range job? Are they oriented toward a research career? Or a ranch business? Are the curricula trying to do all these things and should they? Are all the curricula trying to do the same thing and should they?

Every man is a citizen and functions as an individual in his community. He must be able to grow with and preferably ahead of his community. The University has the responsibility perhaps more than any other institution, except the home, to develop a feeling of social responsibility in the nation's youth. Do the range curricula give the student adequate acquaintance with the "cross-campus" subjects that will whet his appetite for taking part and sharpen his ability to take part in the world around him?

Useful knowledge has no limit but there is a practical limit as to how much can be attained in four years. What are those limits in terms of essential future needs?