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TEACHING PLANS IN RANGE MANAGEMENT
FOR UTAH HIGH SCHOOL VOCATIONAL
AGRICULTURAL PROGRAMS

by

Jack A. Soper

A report submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Agricultural Education

Plan B

UTAH STATE UNIVERSITY
Logan, Utah

1970

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If it were not for men such as these, spending extra time and giving help wherever they could, there would be a lot fewer masters degrees completed.

Others who assisted materially in this study included personnel of the Dixie National Forest and teachers of vocational agriculture from Utah and surrounding states.

Finally, I thank my wife MarLynn, for all the sacrifices made and the support she has given in the preparation of this report.

Jack A. Soper

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INTRODUCTION

Although several course of study outlines have been prepared to cover the subject of range management, the author has been unable to use them too effectively in teaching this important phase of vocational agriculture. Other teachers of vocational agriculture have expressed similar experiences and in group meetings have indicated a need for more teaching materials in range management and other important areas of agriculture.

Panguitch, Utah, where the author teaches, is located in Garfield County in the heart of a vast range area. There is a vital need for youth and adults in the area to understand the important role the rangelands play in their lives. According to authorities in range management, Bureau of Land Management, and U. S. Forest Service, all citizens of the United States should know more about the contributions the Western rangelands make to the total economy and welfare of the nation. Also the citizens should know how important it is to conserve and to further develop these valuable lands.

This report was written to fulfill, in part, the need for teaching plans to assist teachers and therefore help students to get a better understanding of the Western rangelands and how to manage, conserve, and develop them. It is hoped that teachers of Utah and other Western States will be able to use the plans, to develop an attitude and a desire in the students to conserve and improve the Western rangelands and other natural resources of the nation.

The teaching plans in this report are to be used as aids to teachers of vocational agriculture in presenting a beginning course in range management. The material covered in this report may be used as a unit by itself or as a supplement to a course in the field of natural resources. This report is written to serve as a beginning course and should be used in a freshmen or sophomore vocational agricultural class. It is designed to cover from six to eight weeks but could be extended or shortened according to the needs and amount of time spent in field study.

There are 13 lessons written on the one enterprise of range management. The instructor using these lessons should plan to work with the federal conservation agencies such as the U. S. Forest Service, Bureau of Land Management, and the Soil Conservation Service. The instructor should plan to spend as much time as necessary with his class in the field in actual range study.

Teachers who use this report should not attempt to use it word for word but as a guide in teaching range management. The different areas of this state and other states will have different problems to solve so the situation and method of motivation will be different with each instructor.

Statement of Problem

Everyone in America has been associated with the field of conservation in the past few years in one way or another. Possibly most people have been associated through the pollution of the air and water upon which they depend so much. But there is still another important one, that of the natural rangeland in the Western United States that give the essential water, meat for the table, fabric for clothing, and recreation

in the form of hunting, fishing, and boating.

There is an important need to educate people all over America to understand what their Western range area is giving them. Not only people in the Western part of the country but people in the Eastern part of the country should be informed about the problems of the Western rangelands and the value of their products. There is a very important need for people both user and non-user here in the West to work with the federal, state, and local conservation agencies to improve and make sure that the people will have continuing use of the natural resources such as range.

There is a golden opportunity to educate the students in the high school to the importance of the natural resources and how people may have continuing use from them. They should be taught to understand and gain a positive attitude towards working with the governmental agencies, private organization, and as individuals to protect, develop, and improve the use of the natural resources such as rangeland, water, air, wildlife and forest.

There is a vital need to teach students both in vocational agricultural classes and other classes such as biology and social science the value of natural resources.

Through new and scientific methods, by teaching units on range conservation and by developing a proper attitude among the people in this great country, people can use and enjoy this great natural resource for ages to come.

Purpose of the Study

The major purpose of this study is to develop a series of teaching

plans for teachers and students of vocational agriculture to familiarize them with the basic skills of managing a range. The plans and aids will be arranged for teaching range management from the bulletin "The Nature and Use of Utah Ranges" by Karl G. Parker, and other references listed.

Some specific objectives are:

1. To develop teaching plans for the use of teachers and students to assist in the teaching and learning of range management.
2. Familiarize teachers and students with the development and use of ranges in Utah.
3. To teach students what a range is and the value of rangelands.
4. Teach students what is happening to Utah ranges and what to do about it.
5. Have students develop a realistic attitude about rangeland and teach them how the governmental agencies are trying to develop public ranges.
6. Have students figure the economics of a range condition.
7. Teach students to recognize and evaluate the various plants found on rangelands.

Need for the Study

Due to the importance of agriculture in the American economy and the importance of agricultural products coming from the Western public rangelands there is an important need for people to become familiar with the use of the public range.

The place to start education of the people, if it hasn't been started earlier, is in the high schools of the country. The youth of the country will be managing and caring for the natural resources of the country in a few years.

There is also a need for the users of the public range to develop a better working relation with the administrators of the public range. Both the users and administrators of the land are working for the same thing, that of more productive rangeland.

The students in a high school vocational agricultural program have a very definite advantage in working towards meeting the needs by: (1) learning to work cooperatively with the governmental agencies and ranchers and (2) learning how to manage the rangelands to get more production from them.

To conserve valuable time, teachers of vocational agriculture may use a format to teach various lessons, especially when the management problems are the same. The following format suggested by teachers of vocational agriculture, state staff, and Utah State University Agricultural Education Department was used to develop the teaching plans in this report.

The format that will be used is as follows:

Enterprise or Area

Lesson (or job): title of job or teaching unit

A. Situation

The local or other conditions and class members that might clarify or influence the job, problem or unit to be taught.

B. Objectives

1. Teacher's

- a. What does the teacher plan to accomplish? What values does he hope to attain on the part of the students?

2. Student's behavioral

- a. It must say what it is that a student who has

mastered the objectives will be able to do.

- b. It must say under what condition the student will be able to do this.
- c. It must say to what extent the student will be able to do this.
- d. It should lead to the "doing" level.

C. Motivation

This is the preparation step. Use suitable illustrations, suggestions, etc., to motivate class members.

C. Study Guides

List specific questions that will enable the learner to study and reach the objectives.

E. References

Books, bulletins, charts, visuals, etc., with pages or chapters given.

F. Plan of Action

Take field trips, use research people in the field.

G. Analysis

Answers will be given on following pages:

The enterprise of the unit is listed as range management with lessons I through XIII following.

Delimitation

This study is limited to the area of range management in the field of natural resources in Utah but may be used in other states that have similar rangelands. It may also be of interest to teachers who are teaching conservation courses in the high schools. It pertains to teachers of vocational agriculture who work with students in vocational agriculture

at the high school level but could work very well for other youth groups such as 4-H clubs and for adults.

This report will be limited to developing teaching plans for one enterprise--range management. Teaching plans will be developed to cover a beginning course in this field.

REVIEW OF LITERATURE

The literature in the area of developing teaching plans in range management for high school vocational agricultural classes is extremely limited. The review of literature includes publications that may be used in developing teaching plans in range management for vocational agricultural programs.

Krebs (1967) has a very beneficial publication for good materials in the field of a problem-solving approach to teaching for vocational agriculture. The publication includes the understanding and planning theory, gives some illustrative plans, explains classroom procedures, states some of the trouble spots which may come about, gives some short-cuts for minimum planning of lessons, and the various ways the problem-solving approach may be used in teaching.

Krebs (1967, p. 3) wrote:

The success or failure of teaching can often be traced directly to the effectiveness of planning. The value of well-constructed plans cannot be overestimated. However, to make a plan just for the sake of having a plan is not enough. The plan must be usable. It must work when the teacher uses it in the classroom. It should reflect both what the teacher needs to do to prepare for teaching and what will happen when the plan is put into operation.

Andrews and Juergenson (1966, p. 3) saw the importance of well-planned teaching when they wrote:

Good teaching, like good public speaking, does not just happen. The most important aims, as well as the most appropriate procedures for attaining these aims are seldom conceived on the spot without prior planning in writing. Impromptu thought and action rarely, if ever, results in peak teaching performance.

The most effective teachers are the ones who have a well-written lesson plan and use them in the classroom.

The authors made a suggested list for lesson planners to follow:

1. The identification. When to teach what, age or group, and approximate number of days.
2. The objectives. Objectives should be kept in mind, state them in terms of behavior, what the student will do.
3. Equipment and materials.
4. Introduction (preparation).
5. Motivation. Tell students the objectives.
6. Presentation. Needs to be accomplished.
7. Concluding activities. Summary, conclusions, review.
8. Application--follow up--try out.
9. Evaluation. Test and observations.
10. References.

Andrews and Juergensen (1966, p. 4) also points out:

. . . just what type of lesson plan to use depends upon what the individual teacher wants or needs written down on paper in order to give the students the experience he wants them to get.

The rest of the publication is made up into general classroom procedure, agricultural occupations and lesson plans for teaching agricultural science.

"The Utah State Course of Study Guide in Range Management, Forestry, and Conservation" (Utah Vocational Agricultural Department, 1967, p. 11-35) is a good source of range teaching material. It also contains the state suggested course of study for range management.

Materials covered in the guide are as follows:

1. Utah--A Range State

2. Range Forage
3. Introduction to range management
4. Rangeland types in relation to range use in Utah
5. Four principles of range operation
6. Plant and animal requirements
7. Important poisonous plants of Utah
8. Grazing and management to avoid poisonous plant losses
9. Reducing losses from poisonous plants

Scarborough, (1967, p. 51) explains we can improve teaching by clearly stating our objectives in teaching.

. . . Not only do we need to be able to clearly state these objectives in behavioral terms that mean something, but to identify the behavioral of the student that will clearly indicate that my teaching objective has been reached in the student.

This is what we are all trying to do, to get the objectives to the students.

In an article written by Howard I. Downer he explains that due to the increase in the population, the demand for food and fiber will increase, but it will also increase the demand on agricultural resources in the conservation area three times.

Downer, (1969, p. 144) states in his article:

As the pattern of land use changes it will be imperative that the conservation, protection and regulation, and recreational utilization of natural resources be coordinated and expanded so that the natural resources needed for agricultural production, recreation, and aesthetic appreciation will not be depleted by one or more of these uses to the detriment of the others. Proper utilization of natural resources will require the employment of increasing numbers of persons who possess certain agricultural competencies and understandings.

Agricultural resources has been established as one of eight instructional areas in vocational-technical education in agriculture by the U. S. Office of Education. Courses of study in agricultural resources at the secondary and post-secondary levels must be developed to meet the needs of

students whose occupational objectives are concerned with conservation, protection and regulation, and recreational use of natural resources. These courses will enable interested students to gain the knowledge, skills, attitudes, and appreciations necessary for entry and advancement in occupations pertaining to agricultural resources.

With the implementing of multiple use of the ranges, range managers are going to have to become more aware of such things as recreation and wildlife on the ranges. As teachers we should be teaching some material on recreation and wildlife as it relates to range management.

Price (1969, p. 149) wrote the following on recreation and wildlife technology:

The instructional program in recreation and wildlife technology is designed to prepare students to be park managers, wildlife area managers, game protectors, and the techniques in other related positions. All of these jobs involve outdoor work and require knowledge of ecology and field biology as well as basic labor, maintenance, and management skills.

There are many resources available in teaching conservation at the high school that may be used. In studying range management or other conservation courses, there should be some time spent in field study.

Karpiak (1969, p. 155) wrote the following on using available resources:

There are many resources available that can be utilized to teach effectively units of instruction in conservation education in and around local school districts. Students like working in the field and indicate a desire to continue to study conservation using land laboratory facilities.

It has been our experience that facilities are available locally to teach new courses that require land laboratory facilities. Teachers of agriculture should explore local resources to help implement new courses of study that enrich present curriculums in vocational agriculture to meet better the needs of students.

Stoddart and Smith (1955, p. v) wrote as an introduction in their book the following:

American ranchers, after some hundred years of intensive use of the western range, are only now realizing that there

are no new frontiers and that present resources must be made to last us forever. Land misuse and resultant soil erosion will no longer be tolerated by a livestock industry whose future lies undeniably in the soil. Misuse results in decreased production, whereas increased production is the goal of range management. Because of the demand for better management, range research is developing at a rapid rate, simulated not alone by the scientist but by the rancher himself.

This is a very good book to be used by teachers as a reference.

It covers all the areas of range management.

Stoddart and Smith (1955, p. v) also state:

The western United States is predominantly range land and has land use and economic problems peculiar to it alone. These differ from the problems of eastern states and of most other countries because of certain characteristics that limit production in the West. The most important of these is the low and often poorly distributed precipitation made the more serious because of shallow and unstable soils. The results are sparse vegetation and a landscape marred by erosion.

The limited resources give livelihood to a sparse human population, which derives wealth essentially from minerals, irrigated farming, and grazing livestock supported largely on native vegetation. The supervision and maintenance of the range lands are problems second to none in the West in importance. This is the field of range management, the science and art of obtaining maximum livestock production from range land consistent with conservation of the land resources.

TEACHING PLANS FOR UTAH RANGE MANAGEMENT FOR UTAH

Enterprise--Range ManagementLesson I (job I): the history of the range and determining the importance of the range in UtahA. Situation

Many students do not know the history or the importance of Utah ranges.

B. Objectives

1. Teacher's

- a. To familiarize each student with the history and development of Utah ranges.
- b. To teach the importance of the range and its conservation.

2. Student's behavioral

- a. Students will write a brief history of Utah and the Western ranges.
- b. The students will be able to determine the importance of range to user and non-user.
- c. Students will develop a positive attitude to the natural resource--range.

C. Motivation

1. Ask class what part of Utah is rangeland.
2. When did the first cattle come to Utah?
3. Are there any range areas in your community?
4. Do any of you have cattle or sheep on the range?

5. Who owns the rangeland in this area?
6. Why is rangeland important?
7. What other values come from our ranges?

D. Study Guides

1. Write a brief history of the ranges in the West.
2. What has happened to the ranges in the state in the past?
3. What is range?
4. Why does Utah range concern you?
5. What do rangelands provide?
6. Why is it important for the non-user of rangeland to promote its conservation and maintenance?

E. References

- Karl G. Parker, The Nature and Use of Utah Range, p. 1-3.
- Stoddart and Smith, Range Management, Second Edition, p. 1-2.

F. Analysis

1. Rangeland played an important role in the settlement and prosperity of the Western United States.
- a. The first cattle and horses were brought into the United States in 1540 from Western Mexico into Arizona, New Mexico, and Colorado. From these herds escaped and abandoned animals began stocking the range area.
- b. The first cattle were brought into Utah in 1777, by the Escalante party. The livestock industry got its big start around 1830 when the settlers from Mississippi valley merged with the livestockmen moving north from Texas.
- c. Cattle brought from \$3.75 to \$120.00 per head depending upon where they were. In Texas you could buy them for \$3.75 and they sold in Utah for \$24.00. In the gold rush areas they sold for \$120.00 per head.
- d. Sheep increased between 1862-1880 due to the loss of cattle caused by cold winters. By 1880 there were 25,000,000 head of stock sheep in the West.
- e. Around 1850 cattle traveled from Texas over the Chisholm trail north and indirectly came to Utah. Cattle were bought in Texas and trailed to Utah for slaughter and breeding stock.
2. Many acres of rangeland have been taken from the livestock industry due to the large military reservations and the encroachment of cities on rural areas, and the building

of the highway system across the state, military withdrawals have taken approximately 1,900,000 acres, national parks 500,000 acres, and highways 6,000 acres.

3. Range is all the land with a permanent cover of native or naturalized grasses, shrubs, forbs, other forage plants, and trees. Land not adapted to regular cultivation. It is land that may be suited for grazing of domestic and wild animals, for water storage, and for recreational use. There are 45 million acres of range in Utah--8.5 million private, and 36 million public.
4. All of us have a stake in the range. It is the major source of our meat supply and is very important in water resources. Water is stored on our range-watersheds in the mountains, in lakes, ponds, reservoirs and underground.
5. Over 53 per cent of the land area in the United States is grazed by livestock in the form of range or pasture. Rangeland and pasture provides 55 per cent of all feed requirements for all livestock. Rangeland production influences and supports other industries such as farming, banks, insurance and agricultural industries. Rangeland provides protection from excess erosion and feed and habitat for wildlife. Recreational enjoyment fits in with other multiple uses of the range.
6. Plan for proper multiple use.
 - a. Hunting, fishing, and other recreation.
 - b. More demand for meat.
 - c. Water for irrigation, home use, industry, and power

production.

7. The non-range users are provided with meat and water from the range. The range is one of our most important natural resources. Seventy-five per cent of the U. S. sheep are found on the Western ranges. A large per cent of the beef feeder cattle come from the Western ranges. There are approximately 300,000 head of cattle, 700,000 head of sheep, 200,000 head of deer, 4,000 head of elk, 300 head of moose, and 200 head of buffalo on Utah ranges. These figures were obtained from Stewart Richards, Research Assistant, U. S. Department of Agriculture Economics. Each person uses 108 gallons of water a day. This water comes from the range and watersheds in the mountains.

Lesson II (job II): locating the areas of Utah rangelandA. Situation

Many students are unaware of the areas and size or extent of rangeland in the State of Utah and in Garfield County.

B. Objectives

1. Teacher's

- a. To teach students to locate rangeland in Utah and Garfield County and to know the amount of rangeland in the state and county.

2. Student's behavioral

- a. Students will make a colored map of Garfield County showing the size, summer, winter, and spring-fall grazing.
- b. Each student will select a vocation in the field of range management in which he may be interested and write a short report on it.
- c. Each student will work with the Bureau of Land Management and the U. S. Forest Service to determine the size and type of rangeland areas in Utah.

C. Motivation

1. How much rangeland is there in Utah?--in Garfield County?
2. In what condition is the rangeland?
3. Where is most of the rangeland found in Utah?

D. Study Guides

1. How much rangeland is there in the Western Range States?
2. How much rangeland is there in Utah? (overlay)

3. Make a map of Garfield county showing the size of range-land. Indicate the seasons of grazing use.
4. What future demands will be placed on rangeland?
5. What opportunities are open for you in range management?

E. References

Karl G. Parker, The Nature and Use of Utah Range, p. 4-6.

Utah Vocational Agricultural Department, Course of Study Guide in Range Management and Forestry and Conservation, p. 11-14.

Lawrence A. Reuss, George T. Blanch, Utah's Land Resources, p. 4-9.

This Vital Earth. Motion Picture Film, Utah State University Film Library.

Heritage We Guard. Motion Picture Film, Utah State University Film Library.

F. Analysis

1. Rangeland in the United States:
 - a. There are one billion acres in the 48 states.
 - b. Most of the rangeland is in the 17 Western Range States--770,000,000 acres.
 - c. Also there are large range areas in Alaska and Hawaii.
2. Utah land use equals 52.7 million acres divided approximately as follows:
 - a. Crops 1.8
 - b. Commercial forest 3.5
 - c. Private range 8.5
 - d. Public range 36
 - e. Total rangeland 45 million
 - f. Other 2.9 million acres are in lakes, national parks on monuments, etc. These acreage figures were taken from the bulletin "The Nature and Use of Utah Rangeland."

Overlay transparency.
3. Garfield map taken from the agriculture land use map. There are 3,238,600 acres of rangeland in Garfield County. Of this 114,300 acres are private, 200 county, 93,800 state and 3,030,300 federal. This range is used as summer, winter, and spring-fall range. See overlay transparency.
4. Needs for the future. In the past a land operator had to produce enough food and fiber for only five persons. By 1975 he will have to produce more than 10 times that

amount. The total red meat requirements for Utah in 1975 will likely reach 235.6 million pounds or 194.7 pounds per person. In order to produce this much more meat we will have to depend more and more on the ranges.

5. There are many occupational opportunities in the field of range management for those young men who like the out-of-doors.

Examples:

- Range management personnel
- Forest rangers or other
- Botanists
- Biologists
- Game management personnel
- Soil and water conservationists
- Range riders
- Ranchers

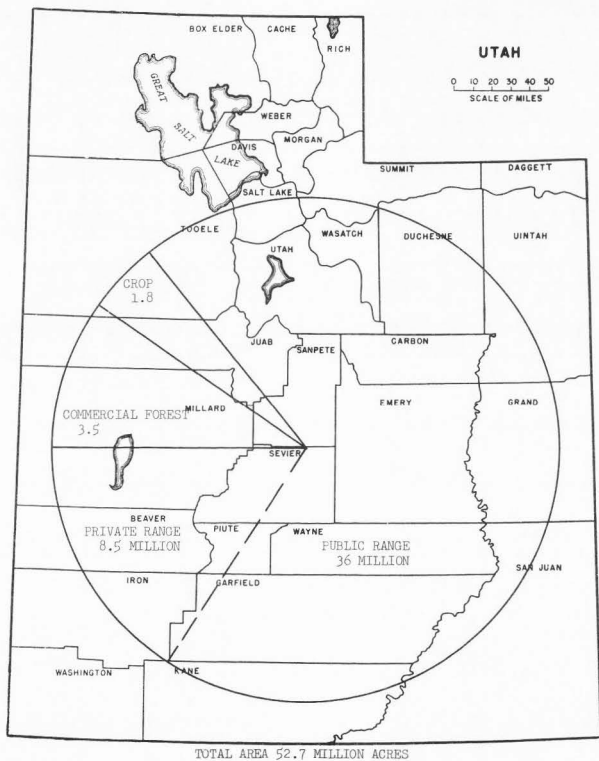


Figure 1. Utah area and land use.

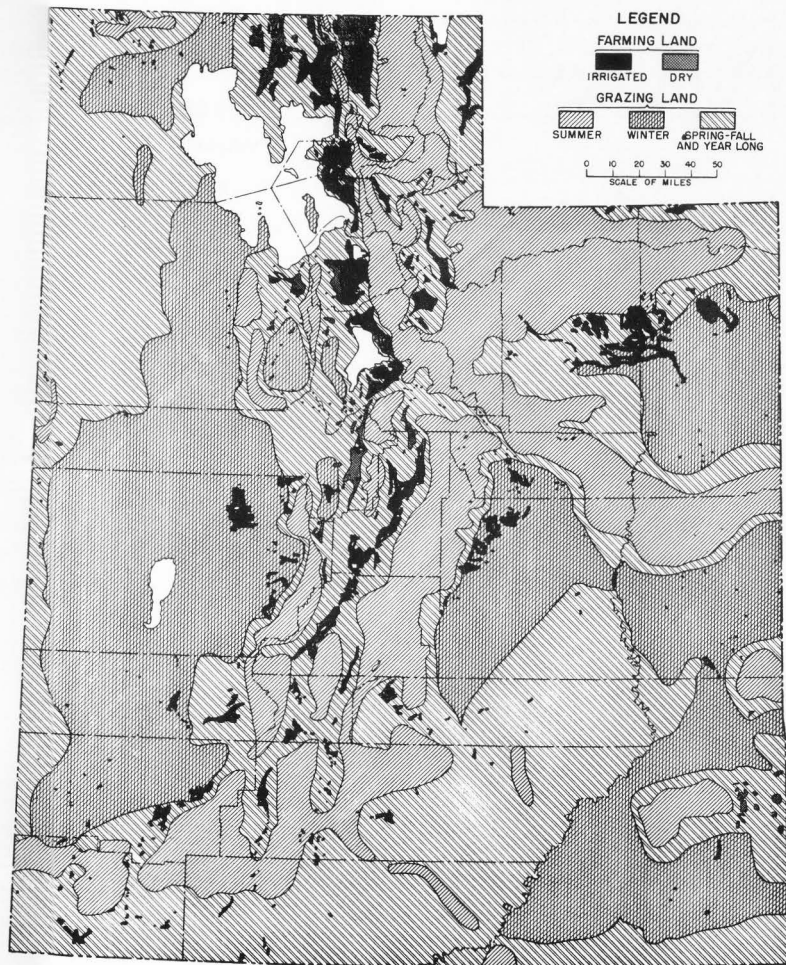


Figure 2. Agricultural land use.

Lesson III (job III): range--a natural resourceA. Situation

Students are not familiar with what range management can do for the range.

B. Objectives

1. Teacher's

- a. To create in the students an interest in range management.
- b. To teach students what a good and poor range is.
- c. To stress the importance of our range as a natural resource.

2. Student's behavioral

- a. Students will list "the steps of knowledge" of range management.
- b. Students will list the various ways range can be maintained in a productive condition.
- c. Students will explain what effect grazing and drought has on a plant community.
- d. Students will draw a graph and explain what three things go on in a plant during the year.
- e. Students will identify several important plants.

C. Motivation

1. Ask class why range is so important in our area, in the state?
2. Ask if we have always had ranges such as we have today?
3. Show by use of pictures, slides, and movies how proper range management can be maintained and improved.

4. Why do some plants make excellent range plants and some poor range plants?
5. Why are some ranges taken over by undesirable plants, while others stay in the desirable range plant type?
6. Show students an example of each of the color groups and explain the differences.

D. Study Guides

1. What is range management?
2. What happens if rangeland gets into a poor condition?
3. What is being done to put the rangeland back into a healthy condition?
4. What are some of the ways we can measure production of a range?
5. What are the goals of range management?
6. How are the goals of range management attained?
7. How can you keep a range healthy?
8. Were there range problems before the white man started using the ranges?
9. What are the "keys" to good range management?
10. Explain what a plant community is?
11. What is a "top" or "climax" range? How does it come about?
12. What is a range site? How do range sites differ?
13. Explain what will happen in a shrub-grass community when a long drought and continued heavy grazing continues.
14. What three things go on in a plant during the year? Why should a range manager be interested in these three plant activities?

15. What is meant by reading the range story?
16. What does each color group of plants indicate in a range site?

E. References

Karl G. Parker, The Nature and Use of Utah Range, p. 5-7.

Karl G. Parker, Livestock Range--Its Nature and Use, Part I.

Dr. Morris Taylor, Dr. Lynn Davis, Dr. Darwin Nielson, Thomas L. Williams, Stephen Olsen, Ronald J. Wolf, Expansion Opportunities in Utah's Livestock Feeding Meat Packing Industry, p. 26.

John F. Vallentine, Important Utah Range Grasses, p. 1-6.

Richer Range Rewards. Motion Picture Film, Utah State University Film Library, Logan, Utah.

F. Analysis

1. Range management is the care and use of rangeland to get the most continuous production of grazing animal products without endangering the range soil, water resources, or other important uses of the land.
2. Poor range conditions mean floods that result in loss of life and property. Valuable water and soil will be lost. Less lamb and beef will be produced to feed our growing population. Utah has some of the best ranges in the West along with some of the poorest. The poor ranges can be improved by proper management and range reseeding.
3. The livestock grower should be well aware of his responsibilities on both public and private range. He, along with government agencies is restoring the rangeland by proper grazing and reseeding when necessary.
4. Measuring production of the range can be expressed by:
 - a. The pounds of meat, wool, and hides. In 1968 there were 130 million pounds of beef and 5.5 million pounds of lamb and mutton consumed in Utah--produced largely on ranges.
 - b. The water for irrigation, for agriculture, for home use, and for industry such as the sawmill.
 - c. The wildlife produced on public domain, National Forest land, and private rangelands such as deer, elk, and sage grouse.
 - d. The recreation provided for the outdoorsman or sportsman such as hunting, fishing, boating, skiing, and/or camping.

5. The goals of range management are high continuous production and beneficial use.
6. To attain the above goals:
 - a. Keep the range covered with good forage plants.
 - b. Use the forage in a way that you will have a continuous use even in poor years.
 - c. Manipulate the vegetation in ways that will increase the storage of water in the soil and result in an "even" flow of water in streams.
 - d. Correlate the range use
 - (1) Livestock
 - (2) Wildlife
 - (3) Watershed
 - (4) Woodland
 - (5) Recreation
7. You can keep a range healthy and productive by knowing the plants and animals that use the range and how to properly manage them.
8. Long before we came there were problems caused by too many wild animals such as buffalo, deer, and elk that sometimes depleted the ranges. There were an estimated 155,500,000 big game animals present originally in the U. S. Utah has had an increase in total numbers of big game animals over the past fifty years.
9. The keys to good range management include the knowledge of:
 - a. What's in the range? What type of plants? What type of soil?

- b. What's happening to the range? Is it getting better or being depleted?
 - c. Learn what should be done to maintain or improve conditions found on the range and then do something about them.
10. A plant community is an aggregation or grouping of plants within a specific area. You may have two different communities in one area such as on the north and south slope of a mountain. Also soil type in a given area will make a difference in plant communities.
 11. A top range or climax range is one that is balanced with the soil and the climate. The plants make the best possible use of available soil nutrients, soil moisture, and the energy from the sun. It takes thousands of years to develop climax range. The plants must be or must become adapted to the range environment to make a top range.
 12. A range site is an area of rangeland where the soil, slope, biotic factors, and climate are similar throughout, but different from adjacent range areas. They differ in that in one area you may have mountains, foothills, or deserts. Range sites differ as to the plants they will best support. Soil types make a difference in range plants found in an area or site.
 13. During a drought and heavy grazing, the less desirable shrubs and the shorter grasses have the advantages because they escape grazing. If a plant is grazed too short and not allowed to make top growth again, the roots are shortened. This makes the plant weak and it

cannot compete for moisture and nutrients with thrifty, ungrazed, unpalatable plants around it.

14. Overlay.

Three things going on in a plant during the years:

- a. Top-growth.
- b. The rate a plant manufactures and uses or stores food.
- c. Root growth.

A range manager should be interested in these three things in order to know the best time to graze the range.

15. Reading the range story means you can look at range and tell if you have the more desirable or less desirable plants on the range. Being able to read the range would tell you if you had the desirable plants like bitterbrush and mountain brome or the undesirable plants like larkspur and loco weed.

16. Color groups of range plants and examples of each follow:

The green group includes the more desirable plants--the ones the animals like best. They control soil erosion.

- a. Mountain brome.
- b. Winter fat.

The yellow group are native plants that are in "climax" range but are less attractive to livestock. These are the plants to watch with caution.

- a. Wild buckwheat.
- b. Indian paintbrush.

The red group means danger as far as range production is concerned. These are the invader plants. They are

usually annuals, woody plants, or unpalatable species which have come from other areas. They take very poor care of the water and soil resources of our range.

a. Quackgrass.

b. Rabbitbrush.

This overlay shows three things going on in a plant during the year. They are: (1) top-growth (top line of diagram); (2) the rate of food that it manufactures (curved heavy line); and (3) root growth. The rate of root growth is shown by the width of the strip just above the months of the year. Plants are most easily injured by grazing when their food storage is used up in the building of tops and roots.

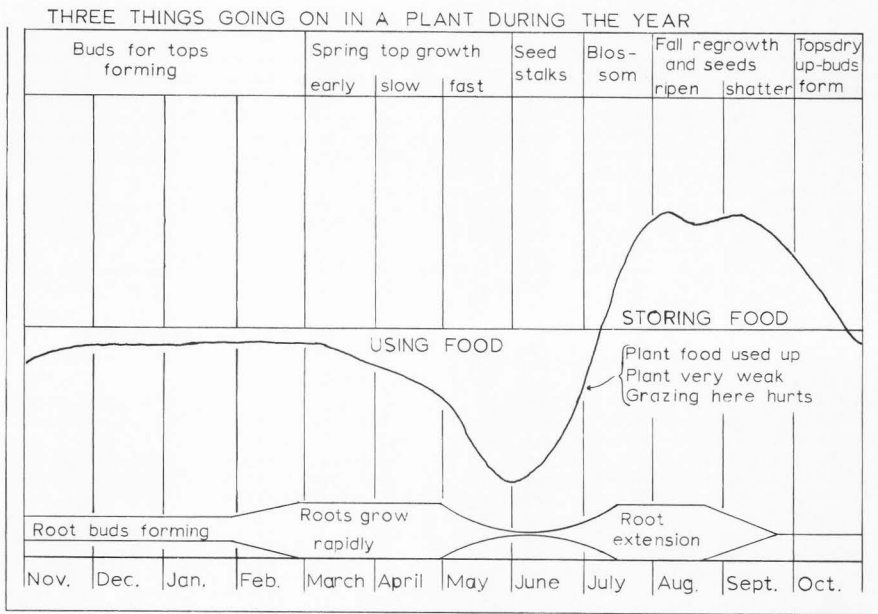


Figure 3. Three things going on in a plant during the year.

Lesson IV (job IV): becoming acquainted with rangelands and soilA. Situation

Many students are unaware of the ecology of the range and how soil, water and plants are all tied together.

B. Objectives

1. Teacher's

- a. To teach students what it takes to make up a range environment.

- (1) Soil
- (2) Plants
- (3) Water
- (4) Energy
- (5) Animals

2. Student's behavioral

- a. Students will be able to determine the rangeland type of soil in their area.
- b. Each student will know what texture and structure of soil means and be able to determine texture of soil.
- c. Students will be able to determine how much grass plant material should be left at the end of the grazing season and why it is important to leave this plant material.
- d. Students will draw and explain the importance of the hydrologic cycle.

C. Motivation

1. Ask class what is the difference between a good range and a poor range.

2. What are the factors that make up a range?
3. Show by examples the difference between structure and texture of soil.
4. Show samples of various types of soil found on the ranges.

D. Study Guides

1. What are the physical or other important features of soil?
2. Why is it important to maintain a deep fertile top soil on our ranges?
3. What is soil texture? What is a sandy loam soil?
4. Why is it important to know what soil structure is when studying range?
5. What consideration should slope be given when studying range?
6. Why is it important to leave some plant material at the end of the grazing period?
7. Why is water such an important factor on the ranges?
8. What is the hydrologic cycle? Diagram and explain the cycle.

F. References

Karl G. Parker, The Nature and Use of Utah Range, p. 7-9.

Karl G. Parker, Livestock Range--Its Nature and Use, Part I.

Our Soil Resources. Motion picture film, Utah State University Film Library.

G. Analysis

1. Features of soil.
 - a. Depth of soil.
 - b. Per cent slope of the land.
 - c. Amount of salt, alkali, white or black.
 - d. Fertility, amount of nutrients in soil such as nitrogen, phosphorus, etc.
 - e. Water availability, amount of rainfall in inches per year.
 - f. Texture, size of soil particles.
 - g. Structure, make up of the soil.

2. We need a deep fertile top soil of approximately 8 inches in order to maintain a vegetative cover on the surface.

If we do not have a good surface cover of plants, we will lose soil through erosion and the range will not support animal life.

3. Soil texture refers to the size of various soil particles within each soil layer. Sandy loam means it is made up mostly of very fine sandy particles with some silt and clay particles. Determine texture by "feeling" the soil. Sand is .50 - .25 millimeters in diameter compared to clay below .002 millimeters.

4. We should know the best soil structures for plant growth and work towards that goal. Structure is the grouping of soil particles into aggregates. Shape of soil particles, crumb, granular, block-like and plate-like. Things affecting the structure are drainage, amount of organic matter, and climate.

5. Soil slope is very important. The steeper the slope the more rapidly erosion will take place. On our steeper slopes we need a more complete cover plant to hold the soil in place. The per cent of slope shows the number of feet fall in 100 feet horizontal. Example a 3 per cent slope would have 3 feet fall in 100 feet of horizontal run.
6. The remains of plants will become part of the soil increasing organic material in the soil and feeding soil organism. Organic matter will breakdown into humus making a more desirable structure. The soil organisms also increase the plant nutrients so the range can produce more forage plants.
7. Water is the factor which most commonly limits production on rangeland. Water is needed by both plant and animals in order to grow. Usually there is a close correlation between vegetation production and precipitation. Usually as the amount of precipitation goes up so does forage production.
8. The hydrologic cycle is the cycle water follows the ocean to the atmosphere by evaporation, back to the land in the form of rain and snow. When precipitation falls on the land, it is used by plants and animals and evaporates from the soil and runs back to the ocean starting the cycle over.

Lesson V (job V): identifying plants and plant groups found on the range

A. Situation

Students are unable to identify plants, parts of plants, or to classify the range plants into groups.

B. Objectives

1. Teacher's

- a. To teach students to identify range plants.
- b. To learn the different parts of a plant.
- c. To teach students the different groups of range plants.

2. Student's behavioral

- a. Students will identify and know the function of plant parts.
- b. Students will draw and label the parts of a grass plant.
- c. Students will identify 25 range plants.
- d. Each student will draw, label, and be able to identify each of the four range plant groups.

C. Motivation

1. Why is it important for anyone studying range management to be able to identify range plants?
2. Why are some plants so much more important than other plants?
3. What plants might be considered dangerous to animals?

D. Study Guides

1. What is a range site?
2. What are the names of the five plant groups? Give a

description, draw and give an example of each one.

3. Explain what is meant by annual, biennial, and perennial plants.
4. What are native plants, introduced plants, cool season plants, and warm season plants?
5. Identify 25 range plants from mounts or field study.
6. Draw a diagram or diagrams showing the following plant parts or identify plant parts from a diagram:

Root	Sheath	Florets
Shizomes	Blade	Glumes
Stolons	Collar	Rachilla
Stem	Ligule	Seed
Nodes	Auricles	Lemma
Internodes	Leaves	Palea
Bud	Spikelets	

E. References

Karl G. Parker, The Nature and Use of Utah Range, p. 11-13.

Karl G. Parker, Livestock Range--Its Nature and Use, p. 5-13.

A. L. Halenaichter, Grasses and Legumes, p. 2-69.

Plant Herbarium, Utah Extension Service Extension Circular #338.

F. Analysis

1. A range site: An area that has similar soil, slope, and climate.

2. Kinds of plants: Overlay

a. Grasses-plants with jointed stems. Stems are generally hollow. Leaves are in two rows on the stem. Veins in the leaves are parallel. They have fibrous root systems.

Examples:

- (1) Western wheatgrass
- (2) Bluebunch wheatgrass
- (3) Cheatgrass-brome

b. Grasslike plants--similar to grasses except that they have solid stems which may be triangular or round but have no visible joints. Veins are parallel in the leaves--sedges and rushes.

Examples:

- (1) Nebraska sedge
- (2) Wire rush

c. Forbs--a forb is a non-grasslike plant with stems (tops) that live only one or two years; leaves have net-like veins (range flowers).

Examples:

- (1) Penstemon
- (2) Lupine
- (3) Salsify

d. Shrubs--a woody plant with stems that live

over the winter and branch from near the base.

Most shrubs have coarse roots.

Examples:

(1) Big sagebrush

(2) Shadscale

e. Trees--large woody plants having leaves or needles.

(1) Quaking aspen

(2) Pinion

3. Seasonal terms defined:

a. Annual plants live only one season, produce seed and die.

b. Biennial plants live two years, produce a well-developed root below ground and a leaf rosette type of growth above ground the first year; second year they produce stem, flowers, and seeds then die.

c. Perennial plants live three or more years, producing seeds each year. In addition to seed propagation they can reproduce by stolens, rhizomes, budding, roots, tubers, or bulbs.

4. Type of plants:

a. Native plants are those which are a part of the original plant cover of a land area.

b. Introduced plants are those which have been brought in from other continents or other land mass areas.

c. Cool season plants make their growth during the cool weather during the spring, late fall or during the winter.

4. Type of plants:

- a. Native plants are those which are a part of the original plant cover of a land area.
 - b. Introduced plants are those which have been brought in from other continents or other land mass areas.
 - c. Cool season plants make their growth during the cool weather during the spring, late fall on during the winter.
 - d. Warm season plants generally make their growth during the summer. They wait for warm weather and develop seed in summer or early fall.
5. Identify 25 plants from the list of 40 plants.
6. Plant parts overlay transparency.

























IMPORTANT RANGE PLANT GROUPS						
	GRASSES	GRASSLIKE		FORBS	SHRUBS	TREES
		Sedges	Rushes			
STEMS	 Jointed Hollow or Pithy	 Solid Not Jointed	 Solid	 Solid	 Solid	 woody Bark
LEAVES	 Parallel Veins			 "Veins" are netlike		
	 Leaves on 2 sides of stem	 Leaves on 3 sides of stem	 Leaves on 2 sides of stem; rounded	 needle-like or scale-like parallel vein		
FLOWERS	 (floret)	 stamen ovary male Female (may be combined)		 Usually showy		 Catkins or showy flowers
EXAMPLE	 Western Wheatgrass	 Threadleaf Sedge	 Wire Rush	 Yarrow	 Big Sagebrush (twig)	 Quaking Aspen

Figure 4. Important range plant groups.

PARTS of GRASS PLANTS

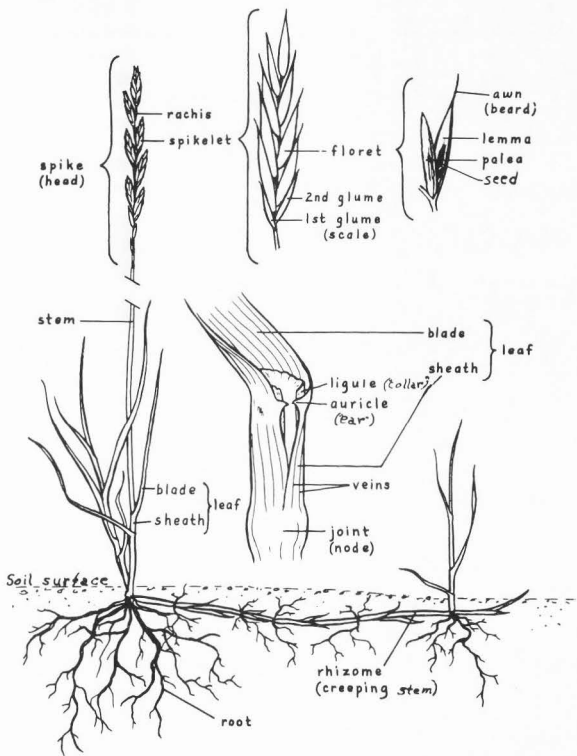


Figure 5. Parts of grass plants.

Lesson VI (job VI): determining factors affecting growing plantsA. Situation

Some students are unaware of how a plant grows and manufactures food.

B. Objectives

1. Teacher's

- a. Teach students what nutrients are needed by plants and what other factors influence plant growth such as water, elevation, slope, shade, temperature, etc.

2. Student behavioral

- a. Students will draw a diagram showing how a plant takes raw material and manufactures it into plant material.
- b. Students will name the major nutrients and explain how they are used by the plants.
- c. Students will become familiar with the other external factors affecting plant synthesis.

C. Motivation

1. What happens to most plants that do not have a good supply of water, sun, and nutrients?
2. Why is it essential that most plants have each one of these?

D. Study Guides

1. Why can we say that a green plant is nature's food manufacturing machine? Show by use of a diagram how plants obtain materials for food manufacturing. Explain photosynthesis.

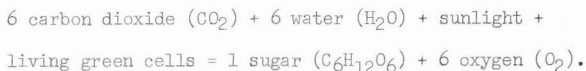
2. What factors influences photosynthesis?
3. Why is water so important to green plants?
4. How is water taken into a plant? How much water does it take to produce a pound of dry forage?
5. What element is taken out of the air? How is this element used in grass growth?
6. How many different elements are used by plants? What are the essential mineral elements?
7. Where are each of the following primary elements used in a grass plant?
 - a. Nitrogen.
 - b. Phosphorus.
 - c. Potassium.
8. What are the secondary plant nutrients, minor plant nutrients and where are they used?
9. What happens to most plants that are shaded by other plants?

E. References

- Karl G. Parker, The Nature and Use of Utah Range, p. 15-17.
- John F. Vallentine, Important Utah Range Grasses, p. 1-3.
- Richard J. Delorit, Crop Production, p. 15-21.
- Stoddart and Smith, Range Management, p. 92-93.

F. Analysis

1. A plant is a machine because it produces material. It uses energy from the sun, water, carbon dioxide, and minerals. These are the raw materials used in manufacturing. It produces sugar for energy and protein for growth. Its waste products are oxygen and water. Plants take in raw materials and get energy from the sun to manufacture food. Photosynthesis is the process of putting together by the use of light energy. Photosynthesis can be explained as follows:



Carbon dioxide absorbed by leaves combined with water by chloroplasts of the cells makes sugar giving off oxygen as a by-product. Must have sunlight as an energy source. Sugar is used as an energy food and is made into more complex materials such as starch and cellulose.

2. Factors influencing photosynthesis.
 - a. Physiological efficiency of the plant.
 - b. Amount of carbon dioxide in air.
 - c. Area of leaf source.
 - d. Intensity of light.
 - e. Water supply.
 - f. Temperature.
 - g. Soil nutrients.
3. Water makes up 70-90 per cent of a green plant and from

8 to 25 per cent of a dry plant. Water acts as a cooling agent by evaporation. It serves as a food and mineral carrier within the plant's body.

4. Most water is taken into a plant through its roots; although a small amount is taken in by the leaves. Green plants need a large amount of water to produce 1 pound of dry matter. Grasses need from 300 to 1,000 pounds of water to produce 1 pound of dry matter. Trees and shrubs need 1,700 to 2,400 pounds to produce 1 pound of dry matter in tree and shrub material.
5. Carbon dioxide is taken in from the air through stomata in the leaves. It is used to make starches, sugars, fats, and proteins in the plant. Oxygen is given off as a waste product.
6. There are 16 mineral elements used by plants. Of these 15 are important, essential mineral elements used by grass. These are calcium, phosphorus, nitrogen, potassium, iron, sulphur, silica, magnesium, cobalt, copper, manganese, zinc, boron, molybdenum, and chlorine.
7. Use of elements:
 - a. Nitrogen is used in the manufacturing of protein. Protein is vital to reproduction.
 - b. Phosphorus is needed for rapid cell division, food making, seed development, and to produce a strong, healthy plant.
 - c. Potassium is a mystery mineral. However, it is apparently needed to assist sunlight in forming other compounds necessary for plant life.

8. Secondary nutrients:
 - a. Calcium is used as a cement to hold cell walls together.
 - b. Magnesium is used in the manufacturing of chlorophyll.
 - c. Sulfur is used in many of the plant proteins; minor plant nutrients such as copper, boron, and zinc are used only in minute quantities for such things as catalysts in plant reactions.
9. Plants that do not receive enough sunlight will not grow properly due to the lack of sunshine to carry out photosynthesis. Some plants are shade loving plants and cannot stand direct sun.

Lesson VII (job VII): collecting range plantsA. Situation

Most students are unfamiliar with the procedure of collecting range plants.

B. Objectives

1. Teacher's

- a. To familiarize the students with the skills and abilities needed to collect and mount plants.

2. Student's behavioral

- a. Collect, mount, and identify range plants.

C. Motivation

1. Show a set of properly mounted plants to class.
2. Explain the importance of being able to identify plants on the ranges.

D. Study Guides

1. Of what value to you is a collection of range plants?
How do you select the plants in your collection?
2. What equipment is needed for collecting and pressing plants?
3. How should plants be selected and collected for mounting?
4. How should plants be pressed?
5. How should plants be mounted and labeled?
6. How can you identify plants you do not know?

E. References

- Karl G. Parker, The Nature and Use of Utah Range, p. 18-20.
- John F. Vallentine, Important Utah Range Grasses, p. 8-46.
- Karl G. Parker, Utah Range Its Nature and Use, Part I: Range Plants and Plant Key, p. 13-30.

F. Plan of Action

1. Take class on a range plant collecting field trip. Collect plants and demonstrate how they should be pressed, mounted, and labeled. Caution students to be selective and collect plants only where it is permissible to do so, and avoid robbing the range of valuable plants that are noticeably scarce.

G. Analysis

1. Your range plant collection will be useful in identifying range plants for future study and identification. You should collect the plants you see as you walk over the range area. You should collect plants over various periods of the year as plants grow and have flowers at various seasons. Collection should be done when flowers are the showiest or when grasses are headed out.
2. Equipment needed:
 - a. Plastic bag
 - b. Sharp knife
 - c. Small shovel
 - d. Plant press
 - e. Newspaper
 - f. Herbarium cards
3. When collecting plants, be sure to get a sample of all the plants. A complete specimen should show the roots, stems, leaves, and flower-heads. Keep plants from wilting until they are pressed.
4. Plants should be pressed in a regular plant press. A plant press can be made out of two pieces of plywood 12 by 18 inches with holes bored for ventilation, a dozen pieces of pasteboard of the same size, some old newspaper, and two heavy straps used for tying the press together. Plants should be folded neatly in a "N" or "V" so it will fit the specimen sheets. Place plant specimen between newspaper, then dryer sheets on each side. Leave in press until plants are dry. Use on

electric fan to ventilate the press containing watery, slow drying plants.

5. Each specimen can be mounted on standard herbarium cards $11\frac{1}{2}$ by $16\frac{1}{2}$ inches. Glue plants to cards. The mounting label or data sheet should be about 3 by 4 inches and glued to the lower right hand corner of the mount with the following information:
 - a. Common name.
 - b. Location where collected.
 - c. Site.
 - d. Collector's name.
 - e. Date of collection.
 - f. Forage value.
6. Plants can be identified by use of a plant key or by taking it to your county agent, vocational agricultural teacher, or ranger. If they cannot identify it, send it to the Herbarium, Utah State University, Logan, Utah.

Lesson VIII (job VIII): determining the value of forage on the rangeA. Situation

Most students do not know the value of range forage and range animal preference to range plants.

B. Objectives

1. Teacher's

- a. To teach students the different values of forage types.
- b. To teach students about multiple uses of ranges.

2. Student's behavioral

- a. Students will evaluate the range forage by drawing graphs, showing the seasonal trends of protein, phosphorous, and carotene content of range forage and seasonal trends in calcium and carbohydrates in range grass.
- b. Students will show by use of a chart the recommended supplement for sheep and cattle on winter range.
- c. Students will explain what multiple use of range means according to forage values.

C. Motivation

1. Why can some ranges in our areas support so many more animals than others?
2. What makes a top quality range for grazing animals?
3. Where are some top quality ranges and some poor quality ranges in our area?
4. What has been done to make these top quality ranges?
5. What has brought about our poor quality range?

D. Study Guides

1. How is the forage value of plants classed? What are the three classes?
2. What types of ranges do sheep and cattle prefer in the spring and summer?
3. What types of ranges do deer and antelope like?
4. By use of graphs show the seasonal trends of protein, phosphorous, carotene, calcium, and carbohydrates of range forage.
5. What are some recommended supplements for sheep and cattle on winter range? What type of feed may be used as a supplemental feed? Show by use of chart.
6. What are some examples of scientific multiple use of range management pertaining to forage value?

E. References

Karl G. Parker, The Nature and Use of Utah Range, p. 21-23.

Edwin V. Rawley, Wildlife Conservation in Utah, p. 22-27.

John F. Vallentine, Important Utah Range Grasses, p. 1-5.

F. Plan of Action

1. Take a field trip to show different range types in the area of the school.

G. Analysis

1. Forage values are placed in three value classes: good, fair, and poor. They are classified by how well they are liked by livestock, nutritive content, and dependability as a forage supply. A top quality range is one that produces the good forage plants and can be used over a long period without ill effect.
2. Sheep and cattle prefer grasses to shrubs in the spring, but they both turn more to shrubs in the late summer and fall. Sheep use forbs in spring and summer. Cattle use more forbs in the later summer.
3. The antelope diet is mainly shrubs in winter and forbs in summer. Deer usually graze on browse species and some forbs.
4. Overlay graphs. Seasonal trends of nutrients in range forage.
5. Recommended supplements for sheep and cattle on three winter ranges:

Table 1. Recommended supplements for sheep on winter range^a

Range	Mostly grass some saltbush	Mixed grass and shrub range	Salt desert shrub range
Protein per cent	36	24	12
Phosphorus	1.5	1.0	0.5
Carotene mg/kg	7.1	3.5	---
Amount of the above ration to feed per day lbs. (of mixture shown in Table 2.)	0.25	0.33 to 0.50	0.2 to 1.0

^aTable prepared by Lorin F. Harris, and Wayne C. Cook.

Table 2. Suggested pellet ration mixtures for cattle and sheep on saltbush type range^a

King of feed	Mixture no.		
	1 pounds	2 pounds	3 pounds
Barley, corn or wheat	--	1275	1960
Cottonseed, soybean or linseed meal	1630	550	--
Alfalfa meal, sun cured	250	125	--
Bonemeal ^b	100	30	20
Mineral mixture ^c	20	20	20
Total	2000	2000	2000
	36% protein	24% protein	12% protein

^a Add sufficient molasses or dried molasses residue to make the pellet stay together, prepared by Lorin E. Harris and Wayne C. Cook.

^b An equivalent amount of phosphorus can be added by using defluorinated phosphate, or monosodium phosphate.

^c Use iodized salt, or iodized salt 100 pounds, cobalt sulfate one-half ounce and copper sulfate one-half pound. Weigh copper sulfate and cobalt sulfate accurately and make a premix before adding it to the salt.

Sheep

It will usually pay to feed a high protein supplement three weeks before the breeding season and for about 30 days before the forage begins to grow in the spring. Lambs and old ewes with poor teeth should be separated from the large band and fed a supplement from about December 20 until shearing time. For these purposes feed one-fourth pound of pellet mixture 1, or one-half pound of pellet mixture 2. If it is impossible to obtain these pellets, feed 43 per cent protein cottonseed cake at the

rate of one-fourth pound per head per day.

A sufficient amount of supplement should be bought in the summer or early fall when prices of feed are down. This supplement should be stored near the sheep. The pellets should be replaced each year to insure an adequate carotene content.

6. Examples of multiple use of range management:

- a. Rest sagebrush--bunchgrass range in the spring and graze in the fall with sheep to control rangebrush and provide better cattle range.
- b. Important deer winter range (browse plants) can be maintained or improved through spring grazing by cattle and fall season deferment.
- c. Grazing by sheep and deer during the growing season helps control shrubs and forbs but favors grasses which are desirable on rangeland watersheds.

SEASONAL TRENDS IN
CALCIUM AND CARBOHYDRATES
IN RANGE GRASS

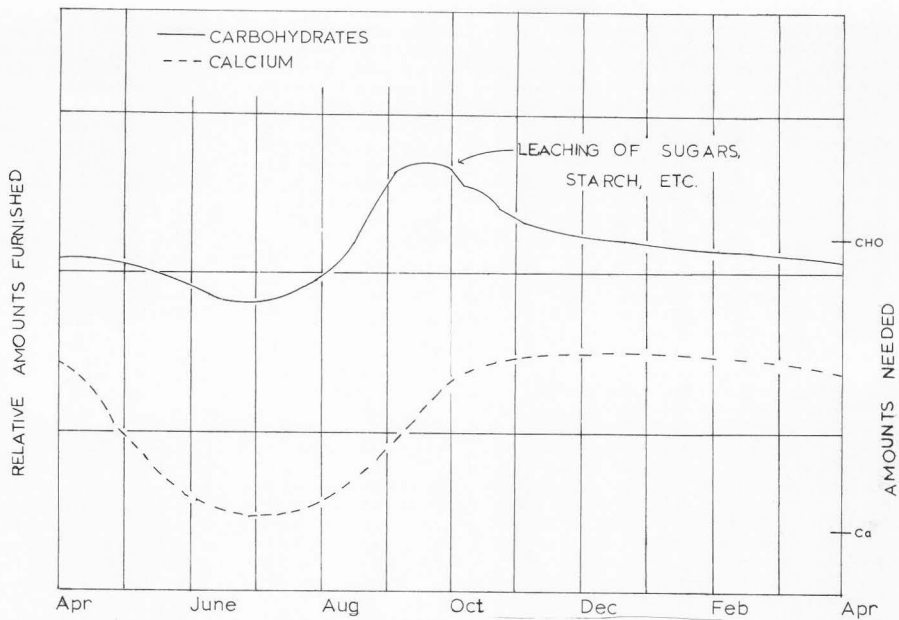


Figure 6. Seasonal trends in calcium and carbohydrates in range grass.

SEASONAL TRENDS IN
 PROTEIN, PHOSPHOROUS, AND CAROTENE
 CONTENT OF RANGE FORAGE

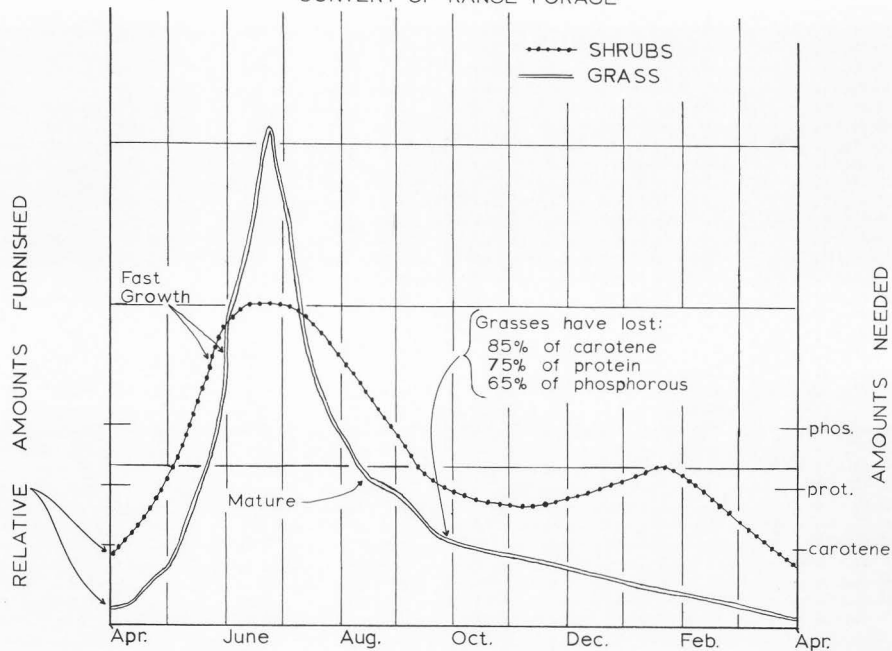


Figure 7. Seasonal trends in protein, phosphorous, and carotene content of range forage.

Lesson IX (job IX): identifying poisonous plants and preventing livestock losses

A. Situation

Students are unaware of the poisonous plants on the range and how to manage livestock on these ranges.

B. Objectives

1. Teacher's

- a. To teach students how to recognize poisonous plants and how to avoid losses due to them.

2. Student's behavioral

- a. Students will be able to identify eleven of the poisonous plants found on the ranges of Utah.
- b. Students will explain in writing how to manage sheep and cattle on ranges infested with poisonous plants.

C. Motivation

1. How many different species of poisonous plants do we have on the ranges? Have you heard of serious losses caused by poisonous plants?
2. Why do some animals eat poisonous plants and some do not?
3. What are some of the affects of poisonous plants on animals? On man? Show pictures of animals that have been affected by poisonous plants.

D. Study Guides

1. Name seven management aids used in preventing plant poisoning?
2. How would you manage your sheep or cattle on a range with loco weed and halogeton found on it?

3. Identify eleven of the poisonous plants shown.
4. What are some plants that cause mechanical injury to animals? How are animals affected?

E. References

- Karl G. Parker, The Nature and Use of Utah Range, p. 24-25.
- L. A. Stoddart, A. H. Holmgren, C. W. Cook, Special Report No. 2
Important Poisonous Plants of Utah, p. 1-4, 7, 9.
- U. S. Department of Agriculture, 22 Plants Poisonous to Livestock
in the Western States, p. 3, 18, 30.
- Reducing Livestock Poisoning Through Management. Slide Series,
Karl G. Parker, Range Specialist, Extension Service, Utah
State University.

F. Plan of Action

1. Take field trip to range area and show students poisonous plants in plant communities.

G. Analysis

1. Management aids in preventing plant poisoning on ranges.
 - a. Know poisonous plants and their characteristics.
 - b. Do not overgraze the range.
 - c. Graze only in the proper season.
 - d. Be careful with hungry animals. Trail slowly.
Make sure animals are full before turning on range with poisonous plants in them.
 - e. Provide ample salt and supplement. Make sure animals are not deficient in minerals and proteins.
 - f. If possible, use a class of stock not poisoned by the plant present. Sheep can graze larkspur without being poisoned, but it would poison cattle.
 - g. Use chemicals such as 2, 4-D to kill the poisonous plants. Use with caution around desirable forage plants because most broad leafed plants are susceptible to 2, 4-D.
2. With loco you have to be careful in the spring and even some winters when it is the most poisonous. Make sure sheep and cattle are well fed before going on the range; and, if possible, keep them out of heavy loco areas. You may treat loco with chemicals. Halogeton is most poisonous in fall and winter, so sheep should be kept away from halogeton areas at this time. After fall and winter snow, halogeton becomes less poisonous.
3. Mechanical injury may be caused by some of the plants belonging to the cactus family by spines in the skin and feet. Cheatgrass seeds often pack under a cow's tongue

leading to lump-jaw infection.

4. Identify the following poisonous plants by use of plant mounts, pictures, and field study:

- a. Locoweed
- b. Larkspur
- c. Lupine
- d. Oak
- e. Rubberweed
- f. Veratrum
- g. Arrowgrass
- h. Water Hemlock
- i. Halogeton
- j. Greasewood
- k. Chokecherry
- l. Death camas
- m. Whorled milkweed

Lesson X (job X): making a range inventoryA. Situation

Students are unfamiliar of how to determine the range condition, how to figure stocking rates, and how to judge range condition.

B. Objectives

1. Teacher's

- a. To show students that range condition may change.
- b. To have students construct a range map of their range and to list improvements to be made.
- c. To create in the students an understanding for calculating initial stocking rates for ranges.
- d. To familiarize students with the range condition guide and score card.
- e. To develop an interest in the students the ways to judge range condition.
- f. To develop the students ability to figure proper stocking rates of range.

2. Student's behavioral

- a. Students will make a range map and plan the improvements to be made.
- b. Students will identify some range sites and judge the condition of range on the range site.
- c. Students will figure a stocking rate for a range.
- d. Students will determine land capability.
- e. Students will identify the conditions of range: excellent, good, fair, or poor.

C. Motivation

1. Why is it important to know if a range condition is changing?
2. How can you tell if a range is improving or regressing.
3. Why is it important to have a range map and inventory of your range?
4. Ask members of the class how they know the number of cattle or sheep a range will feed?
5. Ask members of the class how to figure animal units on a range?
6. Why should they place only the proper stocking rate on a range?
7. Ask members of the class why some ranges have become so low in productive capacity?
8. Ask members of the class how they can prevent a good range from being overgrazed?
9. What are some of the other factors that may cause a range to become unproductive?
10. Show pictures of the different classes of range.

D. Study Guides

1. Why is it important to see what effect grazing has on range plants?
2. How can you tell if your good forage plants are increasing or decreasing.
3. Make a range map of your range or one with which you are familiar showing all essentials that are used in managing a range, such as fences, watering places, salt plans, drainage (streams, etc.), range sites, range condition, number of acres in each pasture, buildings and so on.

4. Besides judging range condition for yourself, where else can you get technical help to determine the condition of the range?
5. What factors do you consider in using a range condition score card?
6. What are stocking rates?
7. How are the following figured?
 - a. Total acres in pasture.
 - b. Animal unit months per acre.
 - c. Total animal unit months stocking rate.
8. How would you mechanically measure range forage production?
9. How do you figure how long a cow could graze one acre that had 1,250 pounds of forage on it?
10. How do we judge a range site's potential?
11. What classification terms are used in judging a range site?
12. What conditions make up each range class?
13. How can the kind of plants on a range tell you a story?
14. What are the things to look for when you are judging range condition?
15. Why do we class excellent range as the best class of range?

E. References

Karl G. Parker, The Nature and Use of Utah Range, p. 29-39.

Karl G. Parker, Livestock Range Its Nature and Use, Part III Plant Relationships, p. 6-9.

Stoddart and Smith, Range Management, Second Edition, p. 98-111, 310-317.

F. Plan of Action

1. Take a field trip to a nearby range area and have students:
 - a. Study the three different classes or range and why they are placed in each class.
 - b. By use of range judging score card and range condition guides, judge a range site.

G. Analysis

- 10
1. You should watch your range very closely so you can make certain the effect of grazing is not reducing the amount of green and yellow group plants nor letting the red group plants invade the range. If this is happening, you should make some adjustments in your grazing program, such as using a rest rotation grazing plan or reseeding where necessary.
 2. Make a permanent transect to measure the trend (change) in condition of the range. These permanent samples should be checked every year or two for at least ten years to determine accurately whether the range is improving or going down in condition.
 3. Overlay map shows the importance.
 4. Technical help in judging range may be obtained from Utah State University Extension Service, Soil Conservation Service, the U. S. Forest Service, or the Bureau of Land Management.
 5. Factors on a score card.
 - a. Type of soil
 - b. Types of plants--green, yellow, or red group.
 - c. Animal units per acre.
 6. Stocking units are given in animal unit months (a.u.m.) per acre. That is the length of time, in months, that one cow (or five sheep) can graze on one acre of land.
 7.
 - a. Total usable acres in the pasture are figured by taking acres minus forested acres (where there is

- no feed), ledges, lakes, or other ungrazable acres.
- b. Animal unit months carrying capacity of a site is figured by taking animal unit months per acre, times the number of usable acres in the site. Add stocking rates for all sites in the pasture to get total for entire pasture.
- c. Formula for total animal units initial stocking rate: take total animal unit months of the pasture and divide by number of months in grazing season. This will equal number of animal units to be grazed in the pasture for the season.
8. Mechanical measurement of range forage is made by marking off a circle with a 20-inch piece of string. Clip all forage within the circle at ground level and weigh it. Multiply this weight by 5,000 as there are 5,000 of these in one acre. For example: if you had one-fourth pound, you would have 1,250 pounds of forage.
9. If there were 1,250 pounds of forage produced on one acre, one cow could graze it for 21 days. (Figured the following way.) The cow needs 30 pounds a day. In grazing grass you should leave one-half the grass plant so we have 625 pounds of forage. Thirty pounds a day divided into 625, giving 21, the number of days one cow could graze one acre. Figuring for a year 365 days divided by 21 days equal 17.38 acres.
10. We judge range condition by what the range site is capable of producing in terms of plants.

11. Classes used in judging condition of a range site:

- a. Excellent
- b. Good
- c. Fair
- d. Poor

12. Make up of each range class:

- a. Excellent is where 100-76 per cent of forage yield is from climax plants green and yellow group plants of the site. The range has a heavy mulch and holds water well, with very little erosion. Streams are clear and well regulated.
- b. Good range is where 75-51 per cent of forage yield is from climax plants of the site. The ground is covered. The plants are vigorous, with slight erosion. Streams are mostly clear.
- c. Fair range is where 50-26 per cent of forage yield comes from climax plants of the site. Sub-climax plants produce most of the forage. Some red group plants are found in this class.
- d. Poor range is where only 25-0 per cent of forage yield is from climax plants of the site. More undesirable plants are abundant and vigorous. Soil is poorly protected. Climax plants are weak or lacking. There is much loss of water from run-off and a low soil fertility. Severe droughts are common.

13. The plants can tell you the various influences such as amount of water, amount of grazing, and time of grazing

better than any mechanical device. The growth of the plants is the best "sign" of the condition of the soil and the way the range is grazed.

14. When judging range condition, you should look for the following. Judge range on the basis of how well it fits your idea of perfection. The further a piece of range departs from the ideal for a particular range site, the lower you place it in the scale of "excellent," "good," "fair," and "poor."
15. We class excellent range as the best because it is better able to use and conserve the available moisture, the soil fertility, and the available sunlight. On excellent condition range there is the most productive set of plants that the plant environment on the site permits.
16. An example to show how to use the range condition and site guide to determine the number of acres per animal and total number of animal units given for a range. In the example it is assumed that the total rangeland area is 1,200 acres and that 200 acres are too rocky to use. There are 1,000 acres of usable rangeland. The soil is of the stoney clay type. The grazing season is three months long. The per cent of each plant species is obtained by judgement on by actual range survey. The largest per cent of each species that may be used towards the score is taken from the range condition guide table three. The total of each species allowed towards condition score is 50 per cent which classifies the rangeland as a fair range type. The animal unit months per acre (a.u.m's)

is .15 (taken from range condition guide) table three.
To calculate stocking rate .15 animal unit months per
acre X 1,000 acres equals 150 animal unit months. Divide
three months into 150 animal unit months equals 50 head
of animal units (a.u.) for the site for three months
grazing.

A SAMPLE RANGE MAP

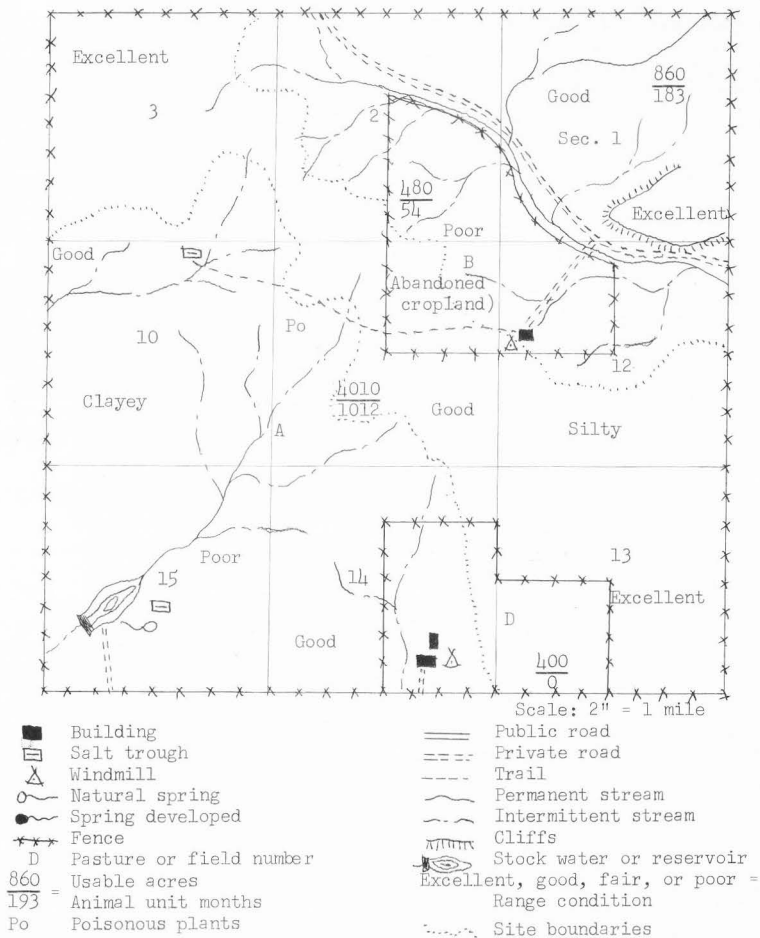


Figure 8. A sample range map.

Name _____ Address _____

Pasture No. _____

RANGE CONDITION AND SITE
Rainfall Belt 12 to 15 Inches Per Year

RANGE SITE Moist, deep <u> </u> Silty <u> </u>	Estimated % of each species in Total forage yield	Largest % you may count toward con- dition score for this range site	Write % of each species allowed toward condition score
<u>GREEN GROUP PLANTS</u> (Decreaser)			
Indian Ricegrass	25	ALL	25
Cliffrose	10	ALL	10
		ALL	
		ALL	
<u>YELLOW GROUP PLANTS</u> (Increasers)			
Bluegrama Grass	30	5	5
Curley Grass	20	10	10
<u>RED GROUP PLANTS</u> (Invaders)			
Broom Snakeweed	15	NONE	0000
		NONE	0000
		NONE	0000
		NONE	0000
TOTAL ALL SPECIES	100%	XXXX	TOTAL SCORE 50
		Animal Unit No. Per Acre (See Guide)	(Copy total score in cor- rect RANGE CONDITION CLASS)
			EXCELLENT 76-100
			GOOD 51-75
Number of head (a.u.'s) that can be grazed on this site for <u>3</u> months <u>50</u> (head)		1.5 a.u.m/ac	FAIR 26-50 50
			POOR 0-25

FORMULA: Acres in pasture less timbered, rocky or other unusable acres, equals usable acres. Usable acres, times Animal Unit Months (a.u.m.) per acre (From suggested Stocking Rate Table) equals a.u.m. in pasture for grazing season. Months in grazing season, divided into a.u.m. equals Animal Units (a.u.) carrying capacity of the pasture for season. To figure how long (months) a pasture will carry a "herd" of animals, divide the a.u.m. for the pasture by the a.u. in the herd. 1 mature cow (with or without calf) or five sheep, equals one a.u. 1 yearling equals .75 a.u. 1 horse or 1 bull equals 1.25 a.u.

Figure 9. Range condition and site score card--an example.

Table 3. Range Condition Guide (Sample for foothill types)

For areas with 10 to 16 inches annual rainfall
Largest percent of each species to be counted toward condition

<u>Green group (decreasers):</u>	<u>Range sites</u>		
	<u>Stony loam</u>	<u>Stony clay</u>	<u>Shallow hardpan</u>
Bluebunch wheatgrass	all	all	all
Indian ricegrass	all	all	all
Nevada bluegrass (native)	all	all	all
Globemallow	all	all	all
Bitterbrush	all	all	all
Cliffrose	all	all	all
Fourwing saltbush	all	all	all
Mountain mahogany	all	all	all
<u>Yellow group (increasers):</u>			
Count no more than percent shown.			
Bluegrama	10	5	5
Curley grass (Galleta)	5	10	5
Needle and thread	all	all	5
Western wheatgrass	---	10	5
Small native bunchgrasses	10	5	10
Balsamroot	5	20	5
Forb that increase	10	15	10
Big sagebrush	10	5	5
Black sagebrush	---	---	5
Juniper and pinon	---	10	40
Oak	5	---	5
Rabbitbrush	5	5	5
<u>Red group (invaders):</u> List but do not count			
Broom snakeweed	none	none	none
Cheatgrass brome	none	none	none
Russian thistle	none	none	none
Tarweed	none	none	none
All annuals	none	none	none
Suggested stocking rates in animal unit months per acre (favorable years)			
	<u>Stony loam</u>	<u>Stony clay</u>	<u>Shallow hardpan</u>
Excellent condition (76-100%)	.4	.33	.30
Good condition (51-75%)	.3	.25	.20
Fair condition (16-50%)	.2	.15	.10
Poor condition (0-25%)	.1	.08	.05

Lesson XI (job XI): improving the rangeA. Situation

Students should be made aware of the range improvements that can be made and how to make them.

B. Objectives

1. Teacher's

- a. To show students the importance of improving practices on the range for livestock.
- b. To develop an interest in improving their range.
- c. To develop an understanding in the students of how range reseeding will increase range production where its needed.
- d. To develop in the students an understanding of what rest rotation grazing is.
- e. To show students how to improve range through range-improved practices.
- f. Make sure students understand the importance of range-improved practices.

2. Student's behavioral

- a. Students will make a range inventory map.
- b. Students will make a range improvement plan on a map overlay and a schedule to carry out improvements planned.
- c. Students will learn how aerial photographs can help in planning range improvements.
- d. Students will make a plan for a rest-rotation grazing system.

- e. Students will determine when reseeding should be started on the range.
- f. Students will improve their ranges by reseeding them where necessary.

C. Motivation

1. Why do some ranchers get so much more grazing value from their range than others do?
2. Who is going to make the most money, a rancher who uses all his range or one who just uses areas of his range?
3. How can you get better utilization of your range?
4. What is being done on some of our ranges in the state now? Why?
5. Why should everyone have a grazing plan for his range?
6. Does the range condition change too slowly to be noticed until it has affected your financial profit or loss, or can you see it change?
7. What can be done to insure good range indefinitely?

D. Study Guides

1. Why are good range improvement practices important?
2. Why are stock watering places so important on our Western ranges?
3. How much water does range livestock need?
4. How may additional stock watering places be developed?
5. Why do we need good fencing on the Western ranges?
6. Why do we need salting places on our ranges?
7. What are five salting suggestions you should follow when salting ranges for cattle?

8. Why and where can we reseed rangeland?
9. Why is seed-bed preparation important in range reseeding?
10. What are the steps you should follow in seed-bed preparation for range reseeding?
11. Why is the control of undesirable plants important in range reseeding?
12. What are the methods of brush control?
13. How are poisonous plants controlled on rangeland?
14. Why should you have a grazing plan?
15. What is a rest-rotation grazing system?
16. Why should every range operator have an inventory or map of his range?
17. What should a range map show?
18. What are management practices based on?
19. How may aerial photographs help you in mapping your range?
20. Make an overlay map of the detailed map you made earlier showing improvements you would make.

E. References

- Karl G. Parker, The Nature and Use of Utah Range, p. 43-46, 47-50, 51-53.
- John F. Vallentine, Wayne C. Cook, L. A. Stoddart, Range Seeding, in Utah, p. 1-5, 5-17.
- Karl G. Parker, Range Plant Control--Modernized, p. 1-14.
- Joseph F. Pechanec, Perry Plummer, Joseph H. Robertson, A. C. Hull, Jr., Sagebrush Control on Rangelands, p. 4-39.
- U.S.D.A. Bulletin No. 327, 22 Plants Poisonous to Livestock in the Western States.
- Stock Water Development, Slide Series, Karl G. Parker, Range Specialist, Extension Service, Utah State University, Logan, Utah.

Seeding Rangeland, Slide Series, Karl G. Parker, Range Specialist
Extension Service, Utah State University, Logan, Utah.

Controlling Undesirable Range Plants, Slide Series, Karl G.
Parker, Range Specialist, Extension Service, Utah State
University, Logan, Utah.

F. Plan of Action

1. Take a field trip to a range and do the following:
 - a. Make some range improvements such as planting trees, shrubs or grass making water improvements or taking salt out on the range. These improvements may be worked through the U. S. Forest Service or the BLM or on some class members range or public range.
 - b. Study some range reseeding before and after and at time of reseeding if possible.
 - c. Working with U. S. Forest Service, BLM, or SCS have students make a range map placing the range improvements they would recommend. Then have one of the professional persons explain what improvements they would make on the same range.

G. Analysis

1. Good range practices increase the amount of usable forage, replace low producing plants with good ones, conserve soil, water, and increase the value of the rangeland.
2. Livestock should have all the water they want without traveling long distances for it. Insufficient water supply is one of our problems on Western ranges. Livestock will graze around watering places and leave the range untouched some distance away. This results in uneven use of range and poor gain on livestock.
3. Amount of water needed by livestock differs with the kind of range, amount of salt consumed, the climate, the season, and kind of stock. Cattle use about ten gallons of water per day, and sheep about one gallon per day. Cattle and sheep should not be made to travel more than one-half to two and one-half miles (depending on type of range condition) from watering places. Watering places should be from one to five miles apart. One water source may serve 1 to 20 sections depending upon the topography of the range.
4. Additional watering places may be developed by the development of springs and seeps, or by putting in wells, tanks, reservoirs, piping water from a source, and possibly hauling water if necessary.
5. Fences are essential because they:
 - a. Prevent trespass by stray stock.
 - b. Distribute livestock and prevent drifting.
 - c. Make possible deferred and rotated grazing.
 - d. Can fence stock out of poisonous plant areas

and reseeded areas.

- e. Makes it possible to separate different classes of stock for better management.
6. Livestock animals need more salt than they can get from plants. Lack of salt causes animals to lose their appetites and lose weight. They do not grow as they should. Salt distribution may offer an excellent means of getting even use of range forage in a pasture.
 7. Salting suggestions:
 - a. Allow 2 pounds per cow per month, one-half pound for sheep per month.
 - b. Place salt one-half mile from water where there is plenty of forage.
 - c. Have a salt ground for 40-50 head of cattle.
 - d. Use a crushed mineralized salt. May have to add dicalcium phosphate also.
 - e. Have a salt plan for each range.
 - f. Place salt in some type of salt protecting trough for protection from weather.
 8. Range reseeding is done in order to increase production of good forage plants. It may be increased as much as three times. Range reseeding may be done where there is more than 10 inches of precipitation per year, if it is done properly. This precipitation should come mainly in the spring and summer.
 9. Seed-bed preparation is very important because young seedling plants are weak and need all the chances they can get in order to establish themselves. Therefore,

all undesirable plants should be removed to give young grass plants all the moisture and nutrients they can get.

10. Steps in seed-bed preparation:
 - a. Shallow tillage should be done just before seeding.
 - b. Drill in seeds one-fourth inch deep, the larger seeds one inch.
 - c. Time of seeding is very important depending on area.
 - d. Type of plants to plant depends on area to be planted and type of stock to graze it.
11. Controlling of undesirable plants such as shrubs should be done because they use about four times more water for growth processes than native grasses. Removing the less desirable shrubs from range can increase forage production and stocking rates.
12. Methods of brush control:
 - a. Use of chemicals such as 2, 4-D and ammates.
 - b. Mechanical implements such as mowing, bulldozing, and chaining.
 - c. By burning.
 - d. By grazing.
13. Control of poisonous plants.
 - a. Chemical control of the certain poisonous plants with 2, 4-D have proven effective. Caution should be used when using chemicals.
 - b. Good grazing management can prevent dangers of poisoning by poisonous plants.

14. In order to get the most economical use of your range, you should have a well-organized plan of your grazing system.
15. Rest-rotation means you have rotation type grazing of the pastures with several numbers of different pastures in a site.
 - a. Graze closely.
 - b. Rest.
 - c. Rest first half, graze second half based on maturity of plants for establishing seeds in the soil.
 - d. Rest for seedling establishment.

On this type grazing you graze one unit of pasture then another, and so on until back to the first. Whatever grazing system is used it should fit the range unit. Rest-rotation grazing overlay transparency.
16. Every good range operator should have an up-to-date range map and inventory of his range in order to see what change is taking place. He should have a list of improvements completed and ones to be completed.
17. A range map should show the following:
 - a. Each site and its condition.
 - b. Vegetative types.
 - c. Trend transects.
 - d. Fences.
 - e. Trails.
 - f. Salting places.
 - g. Natural features such as streams.

- h. Watering places.
- i. Seeded areas.
- j. Plans for multiple use.

18. Management practices are based upon what the map shows as to range condition and forage use in different areas of each pasture. Such things as cross fencing or additional watering places are improvements which might be added.
19. Aerial photographs may help in locating important features on your map. You may even trace them on your map if they are the same scale.
20. Overlay map showing range improvements to be made on range map made in assignment XIII.

AN EXAMPLE OF A REST-ROTATION GRAZING SYSTEM

	YEAR - 1st	2nd	3rd	4th
1	Graze closely	Rest	First half, Rest Second half, Graze for seeding	Rest for seedling establishment
2	Rest for seedling establishment	Graze closely	Rest	First half, Rest Second half, Graze for seeding
3	First half, rest, then graze for seeding	Rest for seedling establishment	Graze closely	Rest
4	Rest	First half, rest then graze for seeding	Rest for seedling establishment	Graze closely

NOTE: Adapt the grazing system to the needs of the range, not the range to the system.

Figure 10. Rest rotation grazing system.

AN "OVERLAY"

This shows how to "map" your plans for the planned range improvements.

Fencing

Stock water development

Trail building

Salting places

Range reseeding

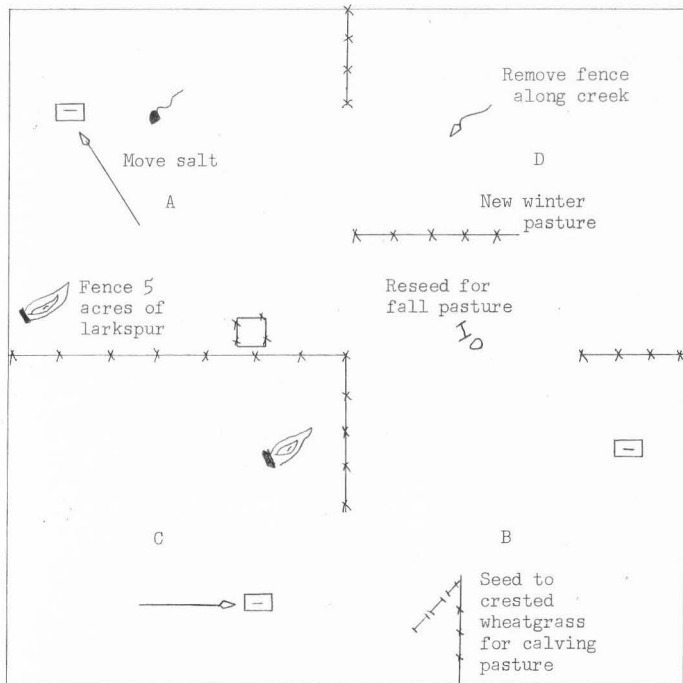


Figure 11. "Overlay" of the improvements on a range map.

Lesson XII (job XII): judging range useA. Situation

Most students do not know how to determine if a range is being used to proper capacity or is being overused.

B. Objectives

1. Teacher's

- a. To bring about an understanding in the students about the importance of proper grazing practices.
- b. To show the students the importance of having a flexible operation for good and poor years.
- c. Try to promote a positive attitude among students towards working with the U. S. Forest Service and the BIM on range improvement and management.

2. Student's behavioral

- a. Students will make a plan for good and poor years in grazing program.
- b. Students will determine if a range is being used to full capacity.

C. Motivation

1. What happens to range when you graze it heavily year after year?
2. How can you tell when range is being grazed properly?
3. Show students pictures, slides, and motion pictures of proper and improper utilization of a range.

D. Study Guides

1. How do the different classes of livestock differ in their grazing habits?

2. What is meant by heavy, light, and moderate use of range?
3. How do you determine proper use or the amount of stubble of a key species to leave after grazing?
4. Why do we use only 50 per cent of the palatable plants in an average year?
5. What other factors should you use in figuring the range grazing load?
6. Make a livestock operational plan so it will fit good and poor grazing years.

E. References

Karl G. Parker, The Nature and Use of Utah Range, p. 40-41.

F. Plan of Action

1. Take class on field trip and make a study to see if a range is being used as it should.

G. Analysis

1. Grazing animals differ in their grazing habits. Cattle will eat more grass and forbs while sheep will eat grass, forbs, and shrubs. All classes of animals will eat the more palatable plants first as they become available.
2.
 - a. Heavy use is indicated when a range has a "clipped" or mowed appearance. Over half of the fair and poor forage plants are used. Heavy grazing year after year is extremely harmful to plants, soil, and animals.
 - b. Light use is indicated when only choice plants are used. There is no use of poor forage plants. Valuable range products are not used. Fire hazards develop.
 - c. Moderate use is indicated when about half of the good and fair forage value plants are used.
(proper use)
3. To determine proper use of a range, the following steps should be followed:
 - a. Wrap mature ungrazed plant with a string.
 - b. Cut the plant off at crown.
 - c. Find point of balance, by balancing on index finger. Measure to this point with a ruler. This amount is about the proper height of use for that particular grass in a season long grazing program.
4. Fifty per cent of the palatable plants are left for necessary litter and for maintenance of the plants and

the site. (For exceptions to this, see "Rest Rotation Grazing.")

5. Other factors such as weather, grazing at proper season, and wildlife of the area should be considered when grazing a range site.
6. The livestock operational span can be kept flexible by:
 - a. Grazing 75 per cent of year-long recommended stocking rate with mother animals. (Make feed reserves.)
 - b. Buying dry animals or keeping offspring when there is extra range forage available.
 - c. Building a feed and cash reserve during good years to withstand droughty years.

Lesson XIII (job XIII): establishing a range "line transect"A. Situation

Students do not know the value of a "line transect" study.

B. Objectives

1. Teacher's

- a. To teach students how to use a line transect to determine vegetative trend of range condition.

2. Student's behavioral

- a. Students will establish a line transect to determine the condition trend of vegetation on a range.
- b. Students will check transect line in the following years of range management study to determine trend of vegetation.

C. Motivation

1. Ask students why it is important to know what the vegetative trend is on their ranges?
2. How can this trend be determined?

D. Study Guide

1. Why do we use a line transect method of sampling the vegetative cover on a rangeland?
2. Why is the line transect method used over other methods of measuring changes in range plant cover?
3. Describe how the method of the line transect is used?
4. What are the steps, procedure and material needed to establish a line transect?

E. Plan of Action

1. Take a field trip to a nearby range and do the following:

- a. Establish a line transect to see what vegetation is there.
- b. In following years of range management study, have classes check the same line transect to see what the vegetative trend is on the range.
- c. Encourage students to establish line transect on their personal ranges for vegetative trend studies.

F. References

1. Some of the material used in this teaching plan was written by Karl G. Parker, Range Specialist, Extension Service, Utah State University, Logan, Utah.

G. Analysis

1. It is useful in determining the trend (changes) of the condition of the vegetation which results from grazing and other influences such as amount of rainfall and other climatic factors. It is useful as a guide in adjusting the grazing use of a piece of rangeland to benefit the desirable range plants--to keep them in a most productive state of health. If you keep your good range plants healthy, they won't be crowded out by low value plants.
2. The line transect has been tried and compared with other methods of measuring changes in range plant cover and found to be most dependable for ranchers' use because it more nearly samples all of the important range plants on a piece of range. While it may seem detailed and even tedious in sod grass covers, the soundness of the information justifies the extra effort. Less intensive methods are often a waste of time.
3. The line transect method may be described as procedure for sampling range vegetation based on the measurement of the intercept of all plants occurring on permanently marked lines without width. These lines are usually 50 feet long in a grass-forb cover and 100 feet long in a shrub-grass-forb cover.
 - a. Get some one-inch angle iron and cut a sufficient number of stakes 18 inches long to allow two stakes for each transect you plan to establish. You will also need one "sentinel" stake six feet tall, preferably of juniper (cedar) for each cluster

of transects. A cluster of transects usually consists of from one to three transect lines in a one-half acre area. Accordingly, you would need two to six angle iron stakes and one sentinel post for each transect cluster.

- b. The location of a cluster of transects requires some judgement. It should be located in an area which will fairly sample vegetation on an important range site in the pasture. The cluster might sample only a ten-acre site, a quarter section, or as much as a section of rangeland if the soils and vegetation are quite uniform. The more variations there are in the vegetation and soils types, the more clusters you will need to adequately sample the vegetation.
- c. Within each cluster, locate the transects in somewhat of a random fashion. Avoid non-typical places for the area. (Don't place a transect on the only rocky knoll in a thousand-acre pasture.) If you plan a three-line cluster of transects, you can locate these randomly by merely tossing three one-foot long sticks over your shoulder but throwing them in three different directions. At each stick, drive your angle iron stake at the near end of each stick and another 50 feet or 100 feet (depending upon whether it's a grass cover or a shrub cover) in the direction pointed by the stick. Leave only three or four inches above the ground.

Avoid crossed line transects or transects too close together. Locate lines to get fair samples of the vegetation.

- d. Prepare a multiple-strand wire one-sixteenth inch or less in diameter (clothesline wire) with loops or one-half inch washers at the zero foot mark, at the 50 foot mark and at the 100 foot mark. Stretch the wire by hand so that it touches the flatwise side of the angle iron stake and at a height of about 6 inches off the ground. The wire is held in place by inserting iron pins through the washers or loops, in the wire, then driving the pins down into the soil far enough to hold the line tightly.
- e. Standard measurement used in line transects is a foot measure--scaled in feet, tenths, and hundredths (preferably not inches). If you can adapt to it, the metric system is even better. Use a ruler or retractible steel tape for measuring plant intercept along the wire.

Measurements of the vegetation are made on the course of this line within its vertical plane and parallel to the line. Each plant growing on the line is measured in a way that will give the numerical value of the ground that is essentially covered by plants under the line.

It will help you in interpreting the changes in plant cover next time you "read" the transect if you lay a tape, calibrated in feet, along and nearby

the transect line. Why? The "RANGE TRANSECT RECORD" form available through your county Extension Office is a chart arranged so that you can record the feet of intercept of various plants along the line according to where they occur on the line. For example, if there is one sagebrush on the line at the four-foot mark upon successive readings, you will be able to tell more accurately the life history of that sagebrush plant and others that may appear or disappear along the line in subsequent years. Some ranchers have made notes on the transect record regarding important plants near the line, but not on the line, for the sake of learning about their behavior in the range under the particular system of management. This sort of innovation makes line transects more interesting and more useful in tracing the trend of the plant cover on the range.

- f. Take two photos standing over the end stake of the transect, one horizontal and one at a 45 degree angle. These help you to locate transects a year or more later.
- g. Fill out the transect record. Be sure to record all of the information needed on the form such as the ranch owner or public land class, the address, by whom the reading is made, the date, the length of transect, the location in miles and direction.

from some well-known landmark, the transect number, where it is by legal description, the vegetational type, and when it is to be reread. Also record the number and types of photographs taken at the transect.

Calibrate the transect record chart on the left hand column, in feet, according to whether the line is a 50-foot or a 100-foot line. Write in the names of the plants at the top of the transect chart, using common names and grouping the plants according to whether they are grasses, grasslike forbs, or shrubs. Write in the most abundant ones nearest to the left side of the chart. It is preferable to have one person measuring the plants and another person recording the measurements on the transect record. Use a pencil of medium hardness. Ink in the figures later.

- h. Measuring the density along the transect line consists of merely measuring the distance occupied on the line by live plant materials (leaves, stems or flowers) either above or below the line. A ruler or a retractible steel tape can be used as a plumb-bob to check your judgment as to whether the plants are on the line or off the line. Do not record any plants that are off the line except as a note, and then you should circle the note so that the measurement is not included in the total for the

line transect. Exclude from the measurements small spots of bare ground which are large enough to accommodate additional plants. On the other hand, barren spots in a grass clump or in a shrub which are too small to accommodate additional plants should be ignored--but not included in the measurement. If you wish, dead grass and litter may be measured and recorded separately. Remember to measure live plant tissues whether directly under or directly over the line. Also, remember the line is a line without width. In some cases you will be measuring the intercept crown spread. In other cases you will record the total aerial spread of the plant. The manner in which you record the spread should be noted and the same system consistently followed in future measurements.

- i. When you have finished measuring all of the plants along the (50-foot or 100-foot) line and total the column for each plant, average the totals for all lines in a cluster; and you will have a good indicator of the relative abundance of each plant in the range site. These figures can be converted to a percentage basis for convenience in determining the relative amounts of the different kinds of range plants on the range site and in the rangeland pasture. The changes in the amounts of these different kinds of plants in relation to their values for grazing, for wildlife habitat, for watershed management,

and for recreational values can furnish the basis
for continued management for high production.

Range transect records are far better than memory. The longer transect records are kept, the more valuable they become. Make extra copies and store them where they will not be lost nor destroyed.

Use your records as guides to range management.

NOTE: For study guide analysis, question number 4 may be mimeographed and handed out to students as a handout.

SUMMARY AND CONCLUSIONS

The objectives of this study were to prepare a set of teaching plans in range management to assist in teaching the enterprise. These lessons were planned to be used as a teaching aid in vocational agricultural in high school classes, other youth groups and adults.

The following is a list of the lesson titles:

- I. The History of the Range and Determining the Importance of Range in Utah
- II. Locating the Areas of Utah Rangeland
- III. Range--A Natural Resource
- IV. Becoming Acquainted with Rangelands and Soil
- V. Identifying Plants and Plant Groups Found on the Range
- VI. Determining Factors Affecting Growing Plants
- VII. Collecting Range Plants
- VIII. Determining the Value of Forage on the Range
- IX. Identifying Poisonous Plants and Preventing Livestock Losses
- X. Making a Range Inventory
- XI. Improving the Range
- XII. Judging Range Use
- XIII. Establishing a Range "Line Transect"

The following conclusions were drawn from this study:

1. It was concluded that there was a need for an outlined plan for teaching range conservation to the named groups--especially for vocational agricultural teachers in the range areas of the state.

2. If followed, these teaching plans will enable a teacher of vocational agriculture to more effectively teach a range conservation course.
3. There is a definite need for all high schools of the state to include more conservation courses such as this one or similar courses treating range watersheds, range wildlife habitat, and range recreation. All people of the state are affected by one or more of these rangeland areas.

LITERATURE CITED

- Ahlgren, Henry L., and Richard J. Delorit. 1959. Crop production. Second Edition. Prentice Hall, Inc., Englewood Cliffs, New Jersey. 666 p.
- Andrews, Dale, W., and Elwood M. Juergenson. 1966. Selected lessons for teaching agricultural science. Interstate Printers and Publishers, Inc., Danville, Illinois. 339 p.
- Downer, Howard I. 1969. Developing a course of instruction in agricultural education. *Agricultural Education* 42(6):144.
- Halenaichter, A. L. 1968. Grasses and legumes. *Agriculture Handbook* No. 339. Soil Conservation Service, U. S. Department of Agriculture, Washington, D. C. 69 p.
- Karpiak, Harry (Ed.). 1969. Use local facilities in teaching conservation. *Agriculture Education* 42(6):155.
- Krebs, Alfred H. 1967. More effective teaching. Interstate Printers and Publishers, Inc., Danville, Illinois. 243 p.
- Lawrence, Reuss A., and Blanch T. George. 1951. Utah land resources. Agriculture Experiment Station, Utah State University, Logan, Utah. 66 p.
- Parker, Karl G. 1968a. Livestock range--its nature and use. Part I: Range plants. 4-H Series A-38, University Extension Service, Logan, Utah. 32 p.
- Parker, Karl G. 1968b. Range plant control--modernized. Utah State University Extension Service, Logan, Utah. 13 p.
- Parker, Karl G. 1969. The nature and use of Utah range. EC359, Extension Service, Utah State University, Logan, Utah. 61 p.
- Pechanec, Joseph F., Perry A. Plummer, Joseph H. Robertson, A. C. Hull, Jr. 1965. Sagebrush control on rangelands. *Agriculture Handbook* No. 227. U. S. Department of Agriculture, Washington, D. C.
- Price, William B. 1969. A new program in recreation and wildlife technology. *Agricultural Education* 42(6):149.
- Rawley, Edwin V. 1970. Wildlife conservation in Utah. Publication No. 69-10, Utah Division of Fish and Game, Salt Lake City, Utah. 48 p.
- Scarborough, Cayce (Ed.). 1967. Teaching effectively--what is it? *Agricultural Education Magazine*, September, 1967. 71 p.

- Stoddart, Lawrence A., and Arthur D. Smith. 1955. Range management. Second Edition. McGraw-Hill Book Company, Inc., New York, New York. 433 p.
- Stoddart, L. A., A. H. Holmgren, and C. W. Cook. 1949. Important poisonous plants of Utah. Agricultural Experiment Station, Utah State University, Logan, Utah. 20 p.
- Utah Extension Service. 1969. Extension circular #338 plant herbarium. County Agent Offices throughout Utah.
- Utah Vocational Agricultural Department. 1967. Course of study guide in range management, forestry and conservation. Utah State Department of Education, Salt Lake City, Utah. 84 p.
- U. S. Department of Agriculture. 1968. 22 poisonous plants, poisonous to livestock in the western states. U. S. Department of Agriculture, Agriculture Information Bulletin No. 327, Washington, D. C. 64 p.
- Vallentine, John F. 1961. Important Utah range grasses. Extension Circular 281, Utah State University, Logan, Utah. 48 p.
- Vallentine, John F., Wayne C. Cook, and L. A. Stoddart. 1963. Range seeding in Utah. Extension Circular 307, Utah State University, Logan, Utah. 20 p.
- Williams, Thomas L., Morris Taylor, Lynn Davis, Darwin Nielson, Stephen L. Olsen, and Ronald J. Wolf. 1970. Expansion opportunities in Utah livestock feeding--meat packing industry. Extension Service, Utah State University, Logan, Utah. 33 p.

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