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File *Office Memorandum* • UNITED STATES GOVERNMENT

TO : A. L. HORMAY, SRC

DATE: October 3, 1958

FROM : KEITH ARNOLD, DIRECTOR

SUBJECT: R-CAL, PUBLICATIONS, Rest-Rotation Grazing

In preparation for your October 20 detail in this office to develop a suitable publication on rest-rotation range management, I am sending you all of the material available here. This material includes your most recent rough draft, some notes on an earlier draft by Clyde Walker, an outline and some draft material for the introduction section.

The outline was developed here. Walker and Woolfolk believe it is suitable for the kind of publication we need. I agree. Also, DeNio and Evanko have reviewed the outline and concur with our views concerning it. As indicated by the outline, this publication should be a "how-to-do-it" or "do-it-yourself" thing. After the introduction, the principles of rest-rotation range management should be set forth. Next is the application phase and finally something on how to judge the success of application.

We want this to be a guide to the application of rest-rotation management principles--something rangers and ranchers can use on their own situations. It should be well illustrated but need not be closely tied to Harvey Valley or Burgess Spring.

As stated in my earlier memo, Clyde Walker will work with you at the start and again in review and editing of your draft. Although two weeks have been set aside for this task you should be able to do it in one week by concentrating on the writing job and largely avoiding attention to other matters.

A copy of this memo is going to Range Management in the Regional Office for Evanko's information.

Keith Arnold

4/2

REFERENCE SLIP

REFERRED TO

*Dwight Walker*

*EJW*

- |  |   |
|--|---|
| <input type="checkbox"/> Action.                 | <input type="checkbox"/> Note and file.           |
| <input type="checkbox"/> Approval.               | <input type="checkbox"/> Per telephone call.      |
| <input type="checkbox"/> Attention.              | <input type="checkbox"/> Previous correspondence. |
| <input type="checkbox"/> Comment.                | <input type="checkbox"/> Recommendation.          |
| <input type="checkbox"/> Consideration.          | <input type="checkbox"/> Record.                  |
| <input type="checkbox"/> Copying.                | <input type="checkbox"/> Rush.                    |
| <input type="checkbox"/> Correction.             | <input type="checkbox"/> Reply for signature of   |
| <input type="checkbox"/> Filing.                 |   |
| <input type="checkbox"/> Initials.               | <input type="checkbox"/> See me.                  |
| <input type="checkbox"/> Investigate and advise. | <input type="checkbox"/> Signature.               |
| <input type="checkbox"/> Memorandum.             | <input type="checkbox"/> To be rewritten.         |
| <input type="checkbox"/> Note and forward.       | <input type="checkbox"/> For your information.    |
| <input type="checkbox"/> Note and return.        |   |

REMARKS:

*What do you  
think of something  
like this?*

*EJW.*

*This is precisely  
what we need, I think.  
How can we put it  
together? Cu*

(Name of sender)

RD  
4/2/58

## REST ROTATION GRAZING

### A MANAGEMENT SYSTEM FOR BUNCHGRASS RANGES

#### Introduction

Historically, bunchgrass ranges of California have been overstocked.

Deterioration has occurred and production is now only 50% of potential.

Research over last 20 years by California Forest and Range Experiment Station has developed basis for management system which will improve grazing capacity and provide high sustained production.

Rest from livestock grazing on a rotation schedule is basis of system.

#### Why rest is needed

Livestock graze selectively--same areas, same species year after year.

Repeated harvest lowers vigor of selected plants and eventually causes death. (Bring in some of Burgess Spring clipping data.) Also, prevents establishment of reproduction (seedlings), bares soil. Leads to soil loss, replacement of good forage species with seeds and other low value plants--end result, lowered grazing capacity.

Plants must have adequate rest from grazing periodically to restore and maintain vigor, produce viable seed, establish new plants, and rebuild soil and soil nutrients.

### How rest can be obtained

Determine amount and frequency of rest needed (depends on range condition and growth requirements of principal species). (Burgess Spring studies showed 1 year rest needed to restore vigor in Idaho fescue, 1 additional to produce seed and get reproduction.)

Divide range into number of equal units required.

Develop grazing schedule.

Maintain schedule.

### How to tell if it's working

#### Positive indicators:

New plants - old ones vigorous

Litter on soil surface

Satisfactory livestock gains

More uniform grazing

#### Negative indicators:

No new plants - old ones dying

Bare soil

Low livestock gains

Spotty range use

## REST ROTATION GRAZING

### A MANAGEMENT SYSTEM FOR BUNCHGRASS RANGES

Livestock ranching, California's first industry, dates back to 1769. Starting at San Diégo with fewer than 200 head of cattle, the Spanish Missions quickly spread northward to Monterey, San Francisco, and other points. Mission Dolores used the east shore of San Francisco Bay--the present locations of Berkeley, Oakland, Alameda, and San Leandro--as a sheep ranch prior to 1820. By 1827 heads of cattle were said to be nearly as numerous in California as buffalo on the Great Plains. Livestock ranching was firmly established from San Francisco south by the mid 1840's. The gold rush of 1849 started a spectacular cattle boom which lasted until 1860 and extended livestock grazing to all remaining parts of the state. In addition to the livestock, pristine herds of deer, elk, and antelope grazed the ranges of California.

As early as 1880, Modoc, Lassen, and Siskiyou counties were among the 10 leading cattle counties of California. Twenty years later these counties gained the same stature regarding range sheep production. These counties contain most of the acreage of perennial bunchgrass range found in California today. They still rank among the leading 20 counties in cattle and sheep production with many times the number of animals claimed a half century ago. Presently cattle numbers are near the all-time high but sheep numbers are only little more than half what they were 20 to 30 years ago.

These facts establish livestock grazing over the past 75 years as a heavy burden on the perennial bunchgrass ranges in northeastern California. Burcham (Calif. Range Land, 1957) cites many examples of heavy range stocking,

some as early as 1820, and the range devastation and livestock losses that occurred as a result thereof. He states further that widespread overstocking was recognized as early as 1850.

Accordingly, California's perennial bunchgrass ranges are very different today than they were a century and a half ago. Loss of palatable, perennial range plants, through too early and too heavy grazing, has been followed by site deterioration and invasion of low value annuals or other undesirable plants. Such changes in composition and reductions in plant vigor with accompanying decreases in herbage production have lowered range production to less than half its potential. Withdrawals for agriculture, urban and other uses have reduced the range by half acreagewise.

Realization of this situation 30 years ago led to the start of research. This research has subsequently developed a basic management system which will rebuild the range and sustain high level production therefrom. Rest from livestock grazing on a rotation schedule is the foundation of this system.

#### Why Rest Is Needed

*Office Memorandum* • UNITED STATES GOVERNMENT

TO : CLYDE WALKER

DATE: FEBRUARY 25, 1958

FROM : A. L. HORMAY

SUBJECT: R-CAL-PUBLICATIONS, Hormay, A. L., Rest Rotation Grazing - - -

CLYDE:

Attached is a "quick shrink" job on the Burgess Spring miscellaneous paper. Your comments on the first draft were very helpful. I got your general idea and agree with it but find it difficult to put in words. The same old trouble - it's sure hard to write with or without distractions. But I think I can make headway more rapidly if I redraft quickly and get reaction like yours to the over-all structure and content, leaving refinement of wording till later. Perhaps with no more than another exchange, this manuscript should go. I'll appreciate your comments on the attached as soon as you can get to it.

Attach.

A handwritten signature in cursive script, reading "A. L. Hormay". The signature is written in dark ink and is positioned to the right of the typed text.

R-CAL  
PUBLICATIONS  
Hormay, A. L.  
Rest Rotation Grazing - - -

February 24, 1958

REST ROTATION GRAZING - - -

A MANAGEMENT SYSTEM FOR BUNCHGRASS RANGES

By

August L. Hormay, Forester  
Susanville Research Center

FOR PUBLICATION

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION  
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE



REST ROTATION GRAZING - - -

A MANAGEMENT SYSTEM FOR BUNCHGRASS RANGES

By August L. Hormay, Forester<sup>1/</sup>

Susanville Research Center

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<sup>1/</sup> The writer wishes to thank the many persons who helped carry out the studies that form the basis of this report, particularly T. S. Brown, the Lassen County Farm Advisor, who assisted with livestock phases; the Cone Range Company, Red Bluff, 1935-38; P. Updike, Hat Creek, 1939; P. McClelland, Standish, 1943-47; L. Jefcoat, Manton, 1948-49; and T. Clayton, Vina, 1951, all Lassen Forest permittees who furnished the cattle and cooperated in other ways; the Lassen National Forest, and many co-workers.

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INTRODUCTION

Profitable range livestock production depends on production of maximum native forage on the range. Knowledge of how this forage can be increased and maintained is essential to the stockmen and range managers. The sustained production of natural forage on ranges depends almost entirely on proper management of grazing.

Fifteen years of research at the Burgess Spring Experimental Range in Lassen County in Northeastern California from 1936 to 1951 has yielded a new grazing system which offers much promise of increasing and maintaining forage production on mountain bunchgrass ranges. This system - called rest-rotation grazing - is described in this publication. The basis for it<sup>was developed</sup> from detailed small-scale studies. It is now being tested on a pilot basis on a 32,000 acre cattle range - the Harvey Valley allotment - on the

Lassen National Forest. The test is in the seventh year and is yielding encouraging results. The system was worked out on cattle ranges but its principles can be applied to sheep ranges as well.

#### RESTING - MAIN FEATURE OF GRAZING SYSTEM

The factor in the system which more than any other is designed to increase forage production and improve the condition of the range is rest - rest from grazing. The idea of resting ranges from grazing is not new. It has been provided for in other grazing systems. Sampson,<sup>2/</sup> in 1914, developed the deferred-rotation grazing system, which include some rest and is applicable to range lands. The present system however calls for longer rest periods than have been recommended heretofore and closer correlation of resting with growth requirements of the vegetation.

#### GRAZING SYSTEM DEVELOPED FOR ROUGH RANGES

Rest-rotation grazing was designed especially for rough mountain ranges where uniform grazing is out of question. The studies that form the basis of the system were carried out on an area of cut-over pine type at an elevation of 6,000 feet, some 40 miles north of Susanville. Ranges in this locality are mountainous and are covered by three main vegetation types -

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<sup>2/</sup> Sampson, A. W., 1914

Natural revegetation of range lands based upon growth requirements and life history of the vegetation. Jour. Agr. Res. 3:93-147.

grasslands, located usually in valley bottoms, sagebrush and juniper on benchlands and gentle slopes and conifer timber - principally ponderosa and Jeffrey pine (Pinus ponderosa, P. jeffreyi) on mountain sides. Idaho fescue (Festuca idahoensis) is the key forage species in the pine type. It is a typical bunchgrass and reproduces from seed. Over 95 percent of the vegetation suitable for livestock grazing on mountain ranges in Northeastern California depends on seed for reproduction.

Precipitation in this region averages between 17 and 18 inches a year. Most of it falls as snow from November to April. The summers are warm and dry. Less than one inch of precipitation falls during July, August and September. The vegetation growing season spans the period from the beginning of April to the beginning of August. The vegetation grows most rapidly in June, ripens seed in early August and dries rapidly thereafter. These ranges are used by livestock mainly between June 1 and October 1.

#### WHY REST IS NEEDED

Ranges need rest from grazing because grazing in almost any practical amounts is damaging to the vegetation. It is a commonly known fact that plants can be killed if kept defoliated for a long enough period of time because without top growth the plant is deprived of means of making food for itself. Clipping studies with Idaho fescue, for example, showed that persistent

defoliation to a 1.5 inch stubble was destructive to this species. In a particular kind of growth year a single defoliation to a 1.5 inch stubble when the plant was growing rapidly was sufficient to kill the plant. Although less damaging clipping was harmful *at* other growth stages, particularly during the growing period. Four years of continuous clipping at the seed-in-milk stage reduced the basal area of a group of plants 80 percent. Such close persistent cropping occurs on the range so the question may be asked, How does it occur? Is it harmful? and if so, Can it be avoided?

Answers to these questions were obtained from observations on the grazing habits of cattle and the effect of cattle grazing on the vegetation.

#### HOW CATTLE GRAZE THE RANGE

Cattle were found to graze the range very selectively. They grazed particular forage species on particular areas in preference to others resulting in very uneven use of the vegetation. (Fig. 1). There was great variation in utilization even of one species on a given site. In one year for example, 40 percent of the Idaho fescue plants in timber openings were grazed to a 1 inch stubble, 29 percent to a 2 inch stubble, 13 percent to a 3 inch stubble and 3 percent to a 4 inch stubble. 15 percent of the plants were not grazed.

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ALH-468

Figure 1.--Some areas on the range like that shown in the foreground here are cropped consistently closely year after year, while other areas like that in the background are only moderately or lightly grazed because of the grazing habits of cattle. This selective grazing is a prime factor in deterioration of the range.

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ALH-468

Figure 1.--Some areas on the range like that shown in the foreground here are cropped consistently closely year after year, while other areas like that in the background are only moderately or lightly grazed because of the grazing habits of cattle. This selective grazing is a prime factor in deterioration of the range.

Plants on some readily accessible or preferred areas were grazed closely whether stocking on the range was light or heavy. Openings in the timber stand, for example, were grazed consistently more closely than areas under trees and some openings were grazed more closely than others. Use in some openings was destructively close when the range as a whole was utilized only 18 percent. The broad pattern of use stemming from selective grazing was similar from one year to the next even though different cattle were grazed on the range each year.

Thus because of the inherent grazing habits of cattle, plants on some areas on the range are grazed closely even under moderate or light stocking of the range as a whole. Continuous grazing of this kind results in loss of forage production.

#### EFFECT OF SELECTIVE GRAZING ON FORAGE PRODUCTION

Eight years of comparatively moderate utilization (averaging 31 percent) of the available forage in open areas in the timber stand, reduced the density of Idaho fescue in openings 21 percent. (Fig. 2.) This amounted to a loss of about 25 pounds herbage production per acre. The reduction in stand occurred principally on the more accessible, preferred grazing areas.

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ALH-749

Figure 2.--A large portion of the Idaho fescue tufts shown on this area have been killed by cattle grazing. Cattle prefer certain areas like this and graze them closely almost every year. Such persistent close cropping kills out the better forage species.

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## SUMMARY

A livestock grazing system applicable to mountain bunchgrass ranges was developed from studies conducted at the Burgess Spring Experimental Range in Lassen County, Northeastern California from 1936 to 1951. The system was developed on cattle range, but can also be applied to sheep ranges.

This system is called rest-rotation grazing. Its main feature is the inclusion of the factor of rest in management of grazing in addition to the conventional factors of stocking rate, season of grazing and livestock distribution. The need for rest stems from the selective grazing habits of cattle which is destructive to the range. Cattle grazed certain species of plants on certain areas closely whether stocking of the range as a whole was heavy or light. The pattern of use was about the same from one year to the next. Under this kind of use the better forage plants tended to be weakened and killed out, resulting in loss of grazing capacity.

It was concluded that selective grazing cannot be avoided so long as the range is grazed, but that the harmful effects of such grazing could be counteracted by resting the range from grazing at suitable intervals. A system of rest-rotation grazing was formulated on this premise. The timing and duration of rest is based on the growth requirements of the key forage species on the range - the one species most desired for forage and soil cover. The main purpose of resting is to allow plants to recover

vigor after a period of grazing, produce seed and establish new reproduction.

To provide the needed rest at the proper time, it is necessary to subdivide the range into units, some of which are rested and others grazed each year. Different units are grazed and rested in rotation in different years. The basis for determining the number of units needed, the timing of resting and grazing and other details of the system are described in the text.

A method of appraising the effectiveness of the grazing system in increasing grazing <sup>capacity</sup> and of getting maximum livestock production within the requirements of the system are also described. A practical scale test of the grazing system is under way at the present time on the Harvey Valley cattle allotment on the Lassen National Forest, and is yielding encouraging results.



Selective grazing leads to ever enlarging areas of deterioration because, as the better forage plants are destroyed on preferred grazing areas, livestock are forced to graze on less desirable forage plants or move on to less accessible areas. That ranges deteriorate in this manner is evident on practically every mountain range in Northeastern California.

#### SOLUTION TO PROBLEM OF RANGE IMPROVEMENT

The heart of the solution of the problem of range improvement lies in preventing the first step in range deterioration - namely, preventing the destruction of choice forage species on preferred grazing areas. From the foregoing it is quite evident that there is no way of preventing selective grazing or controlling it sufficiently to prevent damage to the ranges so long as the range is grazed. However, the harmful effects of grazing can be overcome by resting the range from grazing for sufficient periods to allow plants - all plants on all areas - to recover vigor and reproduce. In addition to proper stocking, proper season of grazing and good livestock distribution, periodic resting of the range from grazing, therefore, appears essential for range improvement.

#### APPLICATION OF REST IN MANAGEMENT OF GRAZING

On bunchgrass ranges, increased forage production and range improvement generally, are dependent on continuous establishment of new reproduction of the better forage species. To get this reproduction, vigor must be restored in grazed plants so they can

produce abundant viable seeds. The seed crop must be protected from grazing until ripe. Similarly the young seedlings must be protected from grazing until they can withstand the grazing and trampling to which they are to be subjected. To accomplish these things the range must be rested from grazing at particular times and for particular periods.

The duration and timing of resting is determined by the growth requirements of the key forage species, - the one species that is most desired on the range for forage and ground cover. All other forage species that have equal or less exacting growth requirements than the key species will be maintained by the amount of rest that satisfies the growth requirements of the key species.

#### ILLUSTRATION OF GRAZING SYSTEM

A grazing plan based on growth requirements of Idaho fescue is outlined in the following pages to illustrate the principals in a rest-rotation grazing system.

#### Resting and Plant Requirements

The clipping studies and range observations indicated that two full growing seasons of rest from grazing are needed by Idaho fescue to recover vigor and produce seed. A minimum of still another season of rest is needed to insure firm establishment of seedlings. In this case four yearly grazing and resting treatments applied in the order shown in Table 1 are needed to get reproduction started.

Office Memorandum • UNITED STATES GOVERNMENT

AA  
6-11  
CMW

TO : DIRECTOR

DATE: FEBRUARY 6, 1958

FROM : A. L. HORMAY, Center Leader

SUBJECT: R-CAL-PUBLICATIONS, Hormay, A. L., Rest Rotation Grazing - - -

REC'D  
Please work with Reg to get this information out as soon as possible. I did not read.

Following up on your oral request while I was in Berkeley during the year-end holidays, I have prepared a draft of a Research Note or Miscellaneous Paper on rest-rotation grazing based on the Burgess Spring work. A copy is attached. The paper can stand shortening, pointing up and editing, and I'd appreciate suggestions by Joe Woolfolk, Clyde Walker and you.

Early last year Reg De Nio of the R.O. asked Joe Woolfolk and me if the Station could put out a somewhat different kind of handout for Harvey Valley than had been issued up to that time. He visualized a well-illustrated publication, covering the application of rest-rotation grazing on the Harvey Valley Allotment, for use primarily by men of the class of rangers and staff men. Joe and I thought it was a good idea. Reg assigned Tony Evanko to work with me in preparing the manuscript. However, for various reasons neither of us had time to get at it. It is still on the agenda and I will rough it out as soon as I can.

I believe the attached proposed publication will fill some of Reg's needs and should be sent to his office for comments and suggestions.

Attach.

*A. L. Hormay*

*This ~~may~~ should be tied in with all experimental work.*

# Rest-Rotation grazing

--- a management system  
for perennial bunchgrass  
ranges

## I Introduction

A the problem (perplexity)

← got to  
run-down  
range

B. Research has an answer

## II The answer

A Cause of range deterioration

B. needs for restoration

patchy  
area  
chart  
or  
sketch

## III Suggestion for putting the answer to work

A  
B  
C  
D

range managers

Miscellaneous Paper

- 1) could start with first  $\Pi$  p 3
- 2) at end of p. 2 expect to be told why rest is needed - as shown @ B&B
- 3) first  $\Pi$  p 4 sounds like new opening
- 4) Seems too much talk about weed & veg  
7 pp to get down to rice
- 5) Topic sentences hidden or at end of many  $\Pi$ 's. The  $\Pi$ 's start w/ data, for quick reading & simple exposition should start w/ conclusion, draw in data occasionally as a clincher
- 6) Statements sometimes qualified to death see "it appears", "there appears" bottom p. 13
- 7) first  $\Pi$  p. 16 conclusion out of place should be back w/ discuss of clipping table 8
- 8) 2d  $\Pi$ , "not clear why "4... treatments... & therefore 4 units" needed. Should explain what it takes estab Table 2, p. 18 repro. & then say "so 4 units needed)"

9) p. 24 - first II - can't see how this bears on "judging effectiveness"

could use <sup>subheads</sup> more liberally so reader knows where he is. - e.g. separate section of grazing & stocking etc.

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General - I have the feeling this paper is too much like an extended abstract of the USDA report now in the mill. Somehow I believe we do not need to give so much space to <sup>the</sup> expt., methods, & general background. What I envision is something like this:

- 1) The situation -- a concise statement of the problem, the reader's stake in the problem, & the suggested solution (rest)
- 2) Why rest is needed
- 3) How it can be obtained
  - Setting up a r-r grazing system
  - Getting max. livestock prod
4. How to tell if it's working

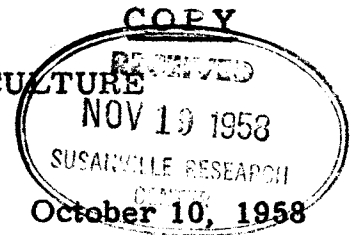
I would omit all the stuff about "importance of management," "condition of...ranges" and "importance of...mountain ranges" (except as stated in the brief introductory T--item 1), "exptl areas & studies" (except as needed to say that <sup>certain</sup> studies show why rest is needed), the summary, lit. cited, & the big table & chart. Lit., tables & chart could be added as appendix.

I would add a picture of Barway Valley with cattle to illustrate "practical test underway" in a concluding statement.

This paper should be much shorter - at least half, in my estimation. We want to invite readers by showing it will take little time to learn all about this new system.

*copies dist'd to all staff*

UNITED STATES DEPARTMENT OF AGRICULTURE  
 Forest Service  
 Washington



To: Station and Laboratory Editors  
 From: Robert T. Hall, Editor, Division of Information & Education  
 Subject: I-PUBLICATIONS-Production (Form of literature citations)

In recent months the question of whether we might be permitted to use the name-date method of citing literature in Department publications has arisen. The name-date method is used in Forest Science. It is preferred by a large majority of scientific readers and authors. The Department Office of Information has said that we may make our own policy in this matter.

The name-date method has several obvious advantages, and in most of our publications it should work out well. Therefore, the station or laboratory editor should decide whether it is appropriate to the manuscript he is preparing for transmittal to the Washington Office. The form of citations in the list will remain the same whether the name-date or number method is used.

With the author-date method, in case there are citations to four or more publications in support of a single point, a footnote reference number should be placed in the text and the citations given in a footnote. The footnote method should also be used in case the title or the body of a table contains a reference to literature. If there are more than two authors of a work cited, only the senior author's name should be given, followed by et al. (Example: Brown et al., 1955)

If citation of four or more publications in support of a single statement occurs several times in a manuscript, the method of citation by number should be used. The reason is that the appearance of printed pages should not be spoiled by large patches of citation material.

As many as five citations are seldom really needed to support a statement. When that many are used, it is a fair question whether bibliographical material has been included. This, of course, is a misuse of literature citations. In such instances the author should be asked to separate the bibliographical material from the literature citations and present two lists. Hence, if it is properly applied, the name-date method of citation will be appropriate in nearly all of our publications.

S/Robert T. Hall

NOTE: The CAL Station will hereafter use the name-date method of citing in all Station multilith releases. We will still need to watch professional journals, of course, and follow their citing style.

C. M. Walker, Publications Officer