

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
REGION THREE

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RANGE MANAGEMENT HANDBOOK
REGION THREE

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INTRODUCTION

A study of grazing within the areas administered by the National Park Service in Region Three has shown a very definite need for proper control and regulation of grazing if we are to comply with the basic rules and regulations establishing the National Park Service; namely, the protection and preservation of the national parks and monuments in their natural state.

Most of the grazing within the national parks and monuments in Region Three has been 'inherited' from permits already in force when the areas were established. Some of the permits are issued by the U. S. Forest Service under cooperative agreements, others have been issued for the lifetime of the persons holding the permit, and they are not transferable upon the death of the original holder or upon the transfer or sale of the property.

In some areas, due to the war emergency we have issued temporary permits based upon a three-year period or until the end of the emergency as proclaimed by the President May 27, 1941, (Proclamation No. 2478). All war emergency permits carry the following provision:

"This permit is issued for a period of three years from _____, subject to the continuance of the national emergency proclaimed by the President May 27, 1941 (Proclamation No. 2478) during said period, and subject further to annual extension thereafter during said emergency in the discretion of the Director of the National Park Service. In no event shall this permit, or any extension thereof, extend beyond the termination of the national emergency above referred to unless expressly extended in writing by the Director of the National Park Service and then only for such period as the circumstances in his judgement warrant. Nothing in this condition shall be construed to supercede or in any way modify, alter, or cancel the provision of No. 7 above."

There is also some grazing being carried on in the national parks and monuments of Region Three by horses and mules used for recreational purposes and for park work. This grazing by pack and saddle stock often precludes any further use of the vegetation by either domestic livestock or wildlife species.

In order to properly protect and preserve the forage resources of the National Park Service until such time as grazing by domestic livestock is terminated, this Range Management Handbook is written as a guide to the field Offices in the administration of grazing. Although we are not interested in the promotion or continuation of commercial grazing in our 'Service' areas, there is every reason for doing a good job of managing those situations which we have on our hands. Through all proper control possible under the circumstances, we can give protection to the park resources involved and thus greatly expedite restoration to natural conditions when the permits are terminated.

RELATIONSHIP BETWEEN THE PARK SERVICE AND THE STOCKMAN

The matter of relationships between the stockman and the park administrator is one which is so often overlooked in our dealings with the public. However, this is one phase of grazing administration which should be stressed at all times.

Range management or grazing administration is a joint responsibility of the permittee and the National Park Service representative. The success of our grazing program is strongly affected by the degree of respect each of them had for the other and by the way in which they work together. This fact imposes a further responsibility upon the park superintendent or ranger--that of understanding the man with whom he is doing business, both as an individual and as a member of an important industry.

The permittee probably grew up with the business. The chances are usually good that he worked for and with his father on the range. During this early period he absorbed practical knowledge of handling livestock and possibly he acquired some practices not now accepted by progressive stockmen. When practices are followed that are not in accord with best usage, an overnight change cannot be expected. Habits of long standing are not broken in such short order.

As the individual grew up with his business he acquired the rugged independence typical of stockmen. His independence resulted from management of his own affairs in a business beset by hazards of weather and the chances of unstable markets. It is also apparent that willingness to take a chance became linked with this independence. The national park officer deals with a man sure of himself and his judgements and often tenacious of the ideas of range management acquired over a long period. Such a man attaches great importance to experience. Only the unwise will challenge that experience, until friendship and mutual understanding and sure knowledge on his part make possible a meeting of minds. The stockman can usually be expected to dislike or resent the following:

Official authority as such; quoting the rules and regulations as the only answer to his arguments; an attitude of intellectual or educational superiority from an official; an assumption that all of the answers are known; a lack of interest in his business; and most of all, a parade of being busy and not having time to sit down and talk things over.

If the superintendent or ranger himself has been brought up in the country or has ranching experience similar to that of the stockman with whom he is dealing, he will start with considerable advantage. The park administrator who is not well versed in the ways of the range should never pretend a knowledge he does not possess. No one is more keenly aware of false pretense than the stockman, particularly if it has to do with things of lifelong familiarity to him. But on the other hand, no one is more generous with advice and suggestions, if the man lacking experience shows a desire to learn.

Failure to listen to advice in the spirit in which it is given will not only deprive the National Park Service of the benefit of the other's experience but will lessen opportunity for cooperation. Courteous acceptance of sound advice paves the way for further suggestion and better cooperation.

No rules can be set up that will insure most effective working relations between the permittee and the National Park Service representative. All the rules in all the books that have been written on human behavior have a way of breaking down under some circumstances. The only safe bet when misunderstandings arise—and many difficulties do arise from misunderstandings—is to endeavor to get the other fellow's viewpoint. When both the permittee and the park service representative seek to understand the viewpoint of the other, the way is paved to amicable solution of most difficult issues!

Time is the one thing required to do business with the stockman. This must be recognized. It is a part of the job. To show impatience or to cut discussion short, is to the stockman, discourtesy.

None of this means that it is necessary or desirable to waive rules or good practice. The respect of the permittee can be lost as quickly for weak failure of the park representative to live up to his code as by the adoption of an official, police-authority attitude. The stockman, too, has his code that deserves recognition and respect—that of fair dealing and standing up to issues.

Getting Management of Livestock on the Range

Responsibilities

As a Joint Job.

To obtain effective and controlled use of the range involves both the permittee and the range manager (park representative). It is a team on a venture in which there is a natural division of responsibility.

The permittee works under a contract—his application, his permit, and the range management plan—and is responsible for so handling his livestock on the range as to carry out its intent. The range manager is responsible for seeing that the contract is just, practicable, protects both the range and the permittee, and that it is lived up to. Neither can do without the other. The permittee, for his own guidance, and to hold up his end, needs from the range manager, a clear cut, explicit plan of management, based on practices of proved worth, fitting his particular range, and economically practicable; a clear understanding of his responsibilities for maintenance or construction of range improvements.

If the manager fails to provide these, he in effect gives to the permittee a power of attorney to make his own management plan and to settle his own responsibilities. The manager should secure from the permittee his ideas on range management based on the results of his operating experience, as well as the need for additional improvements, etc. Joint study on the range itself is an indispensable part of the job. Full mutual understanding of exactly what the job is, the division of responsibility, and the working out of the venture can hardly be obtained otherwise.

The National Park Service also has a responsibility to the permittee, that of furnishing the following information:

1. Advance notification of numbers of livestock allowed for next season.

2. Advance notification of requirements for counting.
3. Notification of earliest date for entry to allotment.
4. Discussion of written plan and map required for management on the range and requirements for maintenance of improvements.
5. Taking the initiative to go over the range with the permittee when inspections are to be made or administrative action planned.
6. A written report on findings and instructions from each range inspection.
7. Written notification of administrative action proposed when instructions are not carried out.
8. Prompt action to prevent trespass on permittee's allotment.
9. Supply current advice on anything that he finds out that will assist the permittee or help to reduce losses, such as springs starting to fail, straying of bulls, etc.

The permittee has the following responsibilities to the ranger or park service representative in charge of his grazing allotment:

1. Full trial of the plan of management before arguing that it is impractical or impracticable.
2. Prompt and workmanlike keeping up of improvements for which he is responsible.
3. Discussion of parts of plan which after trial prove unworkable.
4. Personal attention to livestock on the range, an intimate knowledge of the range, and an effort to go with the manager on inspections.
5. Confirmation of counting arrangement and date of entry.
6. Prompt report of any material change in ranch ownership or livestock status.
7. Immediate action to return livestock to range if advised that it is off allotment.
8. Assistance in preventing and reporting trespass.
9. Full, voluntary assistance in reporting and suppressing forest fires.

The above information has been offered as suggestions to the ways and means of obtaining cooperation from the stockman and is an important phase of public relations in our dealings with them. It may not be practicable in all cases but these things should be kept in mind in our administration of grazing in the national parks and monuments.

The information in the following pages is not intended as a text book on range management, but is presented here to show the effects of grazing upon the vegetation and some of the more important phases of range management to be considered in protecting our parks and monuments until such time as grazing use of these areas can be terminated.

Effects of Grazing Upon The Vegetation

Before entering into a discussion of the various phases of range management it would be well to consider the effects of grazing upon individual plants, as well as, some aspects of vegetative changes due to the effects of grazing.

The principal influence of grazing is that it decreases the plant cover thus allowing greater water losses through run-off and evaporation from the

soil. At the same time the root system of grazed plants tends to be shorter, and as a result, less efficient use is made of the available soil moisture. The total effect of grazing is that it dries out the habitat and hence brings about a change in vegetative cover favoring plants which are able to exist on drier sites.

In some pastures where an excess of moisture results in the growth of coarse grasses and sedges, the pasture would naturally be improved by grazing which dries out the habitat to such an extent that the more palatable grasses could invade. On the other hand, in semi-arid regions, where the moisture balance is precarious at all times, any drying out of the habitat would result in a decrease in the grass cover. Where the growth of the grass roots is curtailed, as under close grazing, moisture is often left in the soil below the reach of the grass roots. In such open stands of grass, if seedlings of taprooted weeds and shrubs are able to survive until their roots reach this underground moisture supply the plants will be in a strong position to compete with the grasses. Utilizing this moisture supply they may be able to dominate the situation by shading out the grasses and by continual competition for soil moisture. If the grazing intensity is sufficiently reduced, the grasses will be enabled to develop root systems which will so fully utilize the soil moisture in the upper portion of the soil that little or none is allowed to percolate downward where it would be available to the deeper roots of the weedy plants. When the existing deeping moisture supply is exhausted, the weedy plants cannot compete with grasses in the use of moisture in the upper soil layer and hence become crowded out.

Effects of Grazing upon Individual Plants

In considering the effects of grazing on the removal of herbage from an individual plant, we should review briefly the aspects of plant development in relation to substances utilized by plants as food.

Plants receive their nutrition from two main sources, the materials obtained from the soil in the form of nitrogenous compounds, and the various ash constituents, and the formation from these substances of the food products proper, mainly carbohydrates, fats, and proteins. The other source is the transformation of the primary food products into substances from which the plant cells and tissues are formed. The leaves and stems of the plants form protoplasm and manufacture food which is stored in the root systems. Since grasses are usually the most important plants on grazing areas, let us consider the effect of grazing upon an individual grass plant.

First of all, grazing is injurious as it destroys the leaves and stems which are part of the food producing elements, thereby destroying the supply of food available to the plant. The new growth begins soon after grazing, provided that conditions such as moisture and temperature are favorable to new growth. Grasses withstand repeated grazing because the growing regions are located at two places--- at the base of each leaf and at each node of the stem. Therefore, as long as a portion of the stem remains rooted, the plant is potentially capable of producing new leafage. Actually, however, it has been found that removal of leafage is closely correlated with root development, and any abrupt change in the amount of food producing activity such as occurs with grazing, causes a corresponding slowing down in root growth. It may thus be seen that repeated and continuous defoliation will cause destruction of the root system and finally death of the plant.

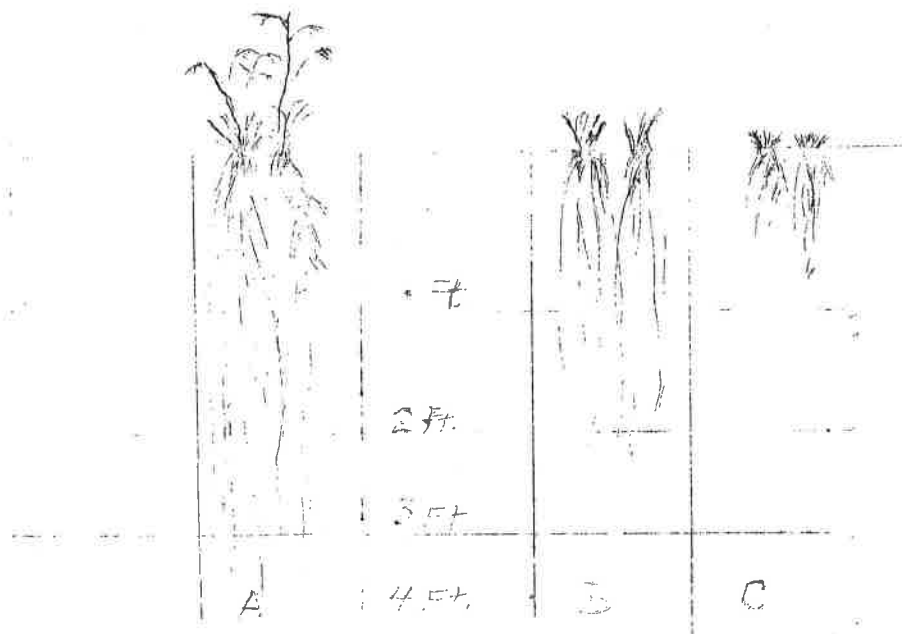


Fig. 1. Blue Grama Plants

A. Plant from properly used range, with maximum vigor, root penetration, and forage production. B. Plant Typical of overused ranges, with low vigor, restricted root system, and low forage production; such plants produce little or no seed even in the best years. C. Plant from heavily overgrazed range, with low vigor, greatly restricted root system, and practically no forage production even in the best years.

With regards to the effects of grazing through the removal of leaves from woody shrubs, the following is generally true; grazing may affect the growth and vigor of the plants in an indirect manner. Defoliation may not result in the death of the plant due to the reserve food stored in the buds, twigs, stems, and roots, which may be sufficient to supply the needs of the plant until new leaves are formed. Continued heavy grazing may effect the vigor of the plant and weaken it until it is unable to produce seed, as all of its energy is used in supplying new leaves and stems to heal the effects of excessive grazing.

Effects of Grazing Upon Plant Communities.

A plant community is any natural group of plants. This group may be small or large, simple or complex, and may be technically called by some special term but it is still a plant community. For example, an area supporting a stand of grasses composed of Wheat grass, Little Bluestem, Buffalo grass and Blue Grama, is a plant community. The effect of prolonged, heavy grazing on this particular type would result in a decrease in the taller grasses which cannot withstand heavy use, allowing the short grass to become established, thereby changing the composition from a tall grass type to a short grass type.

In the southwest there may be a Black Grama type in which the grass predominates, under prolonged heavy use, the grasses are generally crowded out

by weed species such as snakeweed, three-awn grass, and other less desirable species. The final result is a lowering of the carrying capacity of the land through the invasion of the less palatable species. Generally speaking, the most palatable species are eaten first, thereby reducing their numbers in the composition of the forage, leaving the less desirable species to develop and increase throughout the area. The grazing of livestock may change the original palatable vegetation, such as a pure grass cover to a mixed grass and weed type, or it may cause an entirely new plant cover to come in, such as is almost invariably the case on denuded grazing lands.

Effects of Seasonal Use on The Vegetation.

Too early or too late grazing has a very decided effect upon the vegetation. This is particularly true on seasonal ranges where livestock is admitted to the range before the vegetation has reached a point where grazing may be carried on without damage to the forage. For example, in many of our high mountain meadows the cattle are admitted to the area while there is still snow on the ground and the forage has not developed to the point where it may be grazed without damage to both the ground cover and the ground itself. The cattle do as much damage by tramping the existing forage into the mud as they do by actual grazing.

This same condition may exist where livestock is left on the ranges late in the fall after snow has softened the ground. In some cases this trampling may continue until the sod is broken, allowing a small stream to form. This stream may grow in size each year until the moisture is drained from the surrounding soil, leaving a dry sandy area in place of the meadow which formerly existed. This drying out will result in the grasses becoming replaced by other species which are better able to maintain themselves on dry sites, and may even result in the grasses being replaced by trees, such as often happens in the high mountain meadows in California and other high mountain park areas.

The term most generally used to denote the proper time for the opening of the grazing season is--- range readiness--- or "The date in any one year when the range first reaches the condition in which there is sufficient feed to keep livestock in a thrifty condition and when the stock may be admitted without serious impairment of growth and reproductive processes of the more important forage plants."/2. Likewise, the grazing of seasonal ranges late in the fall after the rains and snows tends to destroy forage by trampling as well as excessive grazing. For example, on August 25, 1942, in Mesa Verde National Park, tracks made during the previous winter by horses grazing on Moccassin Mesa were still visible and were three to four inches deep in the dried earth showing the effects of late grazing while the ground is still soft.

In judging the condition of the range in relation to the opening of seasonal ranges to grazing, the following conditions should be noted:

1. The ground should be free of snow and sufficiently dry that damage from trampling will be minimized.
2. The grasses should be at least 6 inches in height with the flower heads and leaf sheaths well formed.
3. The 'range readiness should be judged by the condition of the forage as a unit, rather than on individual species. The time in

each year when the forage is developed to a point where grazing may be safely carried on will vary as much as 30 days, for instance, the high mountain ranges may be suitable for grazing by July 1, this year, while next year perhaps late snows or cold weather may retard growth until they will not be ready for use until August 1. The date of entry of stock onto an allotment should be flexible enough to allow some changes from year to year and not be 'geared to the calendar.'



Fig. 2.

Early spring growth on food reserves in roots carried over from last year. Grazing before 6 in. of growth exhausts reserve before food production is in full swing. Critical stage.

From about 6 in. height the plant begins to make its own food, safe for grazing.

The adult plant manufactures food for volume growth and reserves for next year. Safe for grazing.

The following data composed of suggestions on how to improve livestock ranges is taken from Farmers Bulletin No. 1921, entitled "Improving Range Conditions For Wartime Livestock Production."

1. Examine ranges in the neighborhood in excellent condition that are similar to your own with respect to rainfall, elevations, steepness of slopes, and soil characteristics. Ascertain the history of grazing use—the past and present stocking rates and the manner in which the range is managed. The kind and abundance of forage now being produced affords a satisfactory index of the potentialities of other ranges in the same vicinity having the same general characteristics.
2. Study the condition of each pasture on your own range, noting particularly the kind of vegetation, the vigor, the amount of litter and humus in the soil, and the adequacy of plant cover, litter and humus to absorb water, obstruct run-off, and prevent the accumulation of water into streamlet.
3. Lighten the grazing load on ranges that have declined under heavy stocking. Continuing to graze at the same rate may permit livestock to use fully all the forage now on the range, but it will not permit more nutritious plants to take the place of poor

- forage now growing there, nor allow the better plants to develop a luxuriant growth.
4. Watch the changes that take place in the condition of the range. If, after making allowances for temporary surpluses of forage in good years and temporary deficiencies in poor years, the range is found to be declining, a cut in numbers of livestock will ordinarily be necessary.

A few DON'T to look out for.

1. Don't count on light stocking to produce marked effects on an overgrazed range immediately. Range recovery takes longer than range destruction. The poorer the range, the longer will be the process of recovery, but every gain is a step toward greater production.
2. Don't base the normal rate of stocking on one year's forage production alone. Even a poor range may, in a favorable year, produce a fair quantity of feed, such as it is. Next year it may, normally, be expected to have its usual poor yield. On the other hand, a good or excellent range may have a poor yield during a dry period. If, by chance, growing conditions should turn out to be unfavorable and the forage should be deficient, take part of the stock off in time to prevent damage to the range.
3. Don't allow livestock to graze the plants so closely that insufficient cover is left to hold snow and retard run-off. A loose porous soil, with its dense and vigorous plant cover, absorbs fall and winter moisture and reduces the run-off from spring thaws. This penetration of the soil moisture not only provides moisture for plant growth the following year but also helps to maintain spring, pond, and well-water supplies for livestock.
4. Don't expect light stocking alone, or in all cases, to restore a range to excellent condition. Even a small number of livestock if concentrated in one corner of a pasture, along a water course, or in one pasture for too long a period, may overgraze those places and undergraze the remainder of the range with no benefit to the livestock or the range as a whole.

Apply other good range management practices. Investigate the possibilities of a later season of use, a shorter season of use, rotation of grazing, and means of distributing the livestock over the range more in keeping with the development and relative abundance of the different kinds of forage in the various portions of the range at various seasons of the year.

Range Condition.

The following information is offered as an aid in judging the condition of the ranges in order that the men in the field may be better able to recognize conditions before they become too serious and to help keep them in the best condition possible under existing circumstances.

Range in Excellent Condition.

The soils and plant cover on ranges in excellent condition have usually been little changed by grazing. Such ranges produce as much, or practically as much, forage as they are capable of producing. The plant cover is adequate to hold the soil in place and to maintain or build up its fertility. Excellent range condition is characterized by the superior quantity of the forage.

The majority of the plants are those that provide the greatest possible nutrition to livestock and are sufficiently abundant to prevent losses of soil and moisture under grazing use, and; the kinds of forage plants are those which persist, even when grazed, under the long-time climatic conditions prevailing in the locality, holding their own against other vegetation.

Additional Characteristics of Ranges in Excellent Condition.

1. Vigorous condition of the better forage plants.
2. Good reproduction of the better grasses and other desirable forage plants either by seed or vegetative spread such as, tillering, runners, or underground root stocks.
3. Some litter on the ground under and between plants.
4. Loose and friable top soil containing a certain amount of organic matter, the amount varying according to climate.
5. Soil movement on the grazed range not greater than if same range were ungrazed.
6. Little or no silt in the run-off water.

Ranges in Good Condition.

Ranges in good condition differ from those in excellent condition in the following ways: Although the better perennial plants predominate and are still rather abundant, they have been replaced in part by less nutritive and less erosion-resistant plants, mostly perennials. Ranges in good condition produce markedly less forage of the better kinds of plants than ranges in excellent condition, grazing capacities generally being at least three-fourths as great but not as high as those of ranges in top condition. Slightly less moisture is being retained, and the soil is being lost in slight amounts.

Additional characteristics of ranges in good condition are usually as follows:

1. The vegetation has thinned, and bare spots have appeared.
2. The vitality of the better forage plants has been reduced. The plants have lost color and fail to produce a normal abundance of viable seed or strong, healthy runners or rootstocks.
3. There is insufficient litter under or between plants. As a result, a portion of the rainfall that would normally go into the soil runs off.
4. There has been some washing of the darker top layer of soil and run-off from the range is clouded with silt.

Ranges in Fair Condition.

On ranges in fair condition both the soil and plant cover have been distinctly damaged. The majority of plants making up the plant cover are

definitely less desirable in their value for animal nutrition and soil protection than those on excellent ranges. The poorer, less desirable perennial grasses, not found in quantity on the same kind of range in a healthy state, have largely or entirely replaced the more valuable plants. Annual plants are present in normal years. Such ranges normally produce only one-half to three-fourths of the forage found on similar ranges in excellent condition.

Additional characteristics of ranges in fair condition are usually as follows:

1. The vigor of the valuable forage plants is low, except in protected places. (The poorer plants such as snakeweed or three-awn grass may be fairly thrifty). There is usually no reproduction or spread of the better plants.
2. The density of plant cover and resultant litter is insufficient to protect the soil from washing and blowing and on sloping ranges active erosion is clearly evident.
3. The surface soil shows poor tilth, being hard and crusted.
4. The amount of bare ground is relatively large, the plant cover being insufficient to hide or mask the soil.
5. The run-off water is heavy with silt.

Ranges in Poor Condition.

Ranges in poor condition are highly unstable as regards both soil and forage, and resistance to erosion and run-off is extremely low. Forage plants are low in nutritive value, and the range usually produces less than half the forage which the same range in excellent condition would yield. The primary characteristics of a range in poor condition is the dominance of perennial weeds, unpalatable shrubs, or annual plants. These have largely replaced the perennial grasses, which occur mainly as scattered remnants in protected places. Vegetation may be absent on ranges in extremely poor condition.

Additional characteristics of ranges in poor condition are usually as follows:

1. The vigor of the vegetation is generally low, except for annuals in favorable seasons. Weeds and unpalatable shrubs are thriftier than the perennial grasses. There is no reproduction or spread of the better plants.
2. The ground surface covered by perennials is one-half or less than that of perennials on excellent range of similar character. The density of plant cover and litter on the whole is insufficient to protect the soil from washing and blowing and active erosion is conspicuous.
3. Removal of the top soil by washing and blowing has exposed the sub-soil or has left extensive areas of gravel on the surface.
4. Run-off is extremely rapid, and the silt load of run-off water is extremely heavy.

Changes in Range Condition.

A range in poor condition may be on the mend, whereas ranges in a reasonably satisfactory condition may be on the down grade. Range trend applies not so much to condition in one year as a series of years, for example, a range may decline in one or two years because of drought or use by livestock, but if its condition over a period of five or ten years is noticeably better than in

grama grass. Cattle often chew the leaves of soap weed (*Yucca elata*) and (*Yucca glauca*) probably to satisfy a craving for minerals not found in their diet. Such instances of abnormal use of this type of plant may be due to the vagaries of the cow's appetite and not a condition of overuse. However, when these plants are heavily grazed, the evidence points toward a shortage of other more palatable forage.

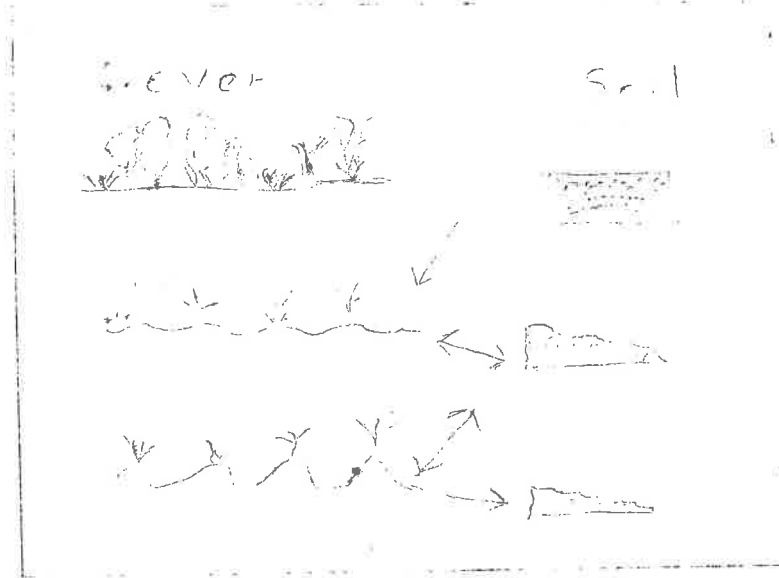


Fig. 3. The vicious Circle Started by Overgrazing. Loss of cover results in loss of soil, which in turn produces a poorer cover, and the vicious circle continues.

Animal Indicators of Overgrazing.

The condition of livestock grazing the ranges is not always a dependable indicator as to range condition, as has been formerly stated by Jardine and Anderson. /3.

In spite of this opinion, there has been a growing feeling within recent years that condition and production of livestock taken together can be used as an indicator of range condition. This is true especially on perennial grasslands used year-long. Maximum production as measured in pounds of livestock is closely correlated with the maximum production of good forage plants.

Regardless of breed, when a rancher raises 1,000 pound cows which produce a 90 percent or better calf crop year in and year out, with the calves averaging better than 400 pounds at weaning time, the range is invariably found to be either in good condition or rapidly improving. On the other hand, if the cattle average around 750 pounds per animal and the calf crop averages around 60 percent or less with light 'dogied' calves at weaning time year in and year out, then something is wrong with the management or there just isn't enough feed on the range. Usually it is found that the latter is the case.

Physiographic Indicators. /1.

Soil is the basic resource of agriculture whether it be farming, the growing of timber, or the production of forage for range livestock. The

wearing away of the soil mantle which covers the land surface by the action of wind and water is an inevitable natural process. Soil erosion is a normal geologic process which has taken place since time immemorial and will continue as long as the earth retains an atmosphere.

This is normal soil erosion. However, the erosional process may be greatly accelerated on soils where the protective growth of vegetation has been altered or disturbed by man and his agencies. Accelerated erosion is generally characterized by one or more of the following happenings:

1. Loose stones, rocks, or gravel cover the ground forming the so-called erosion pavement.

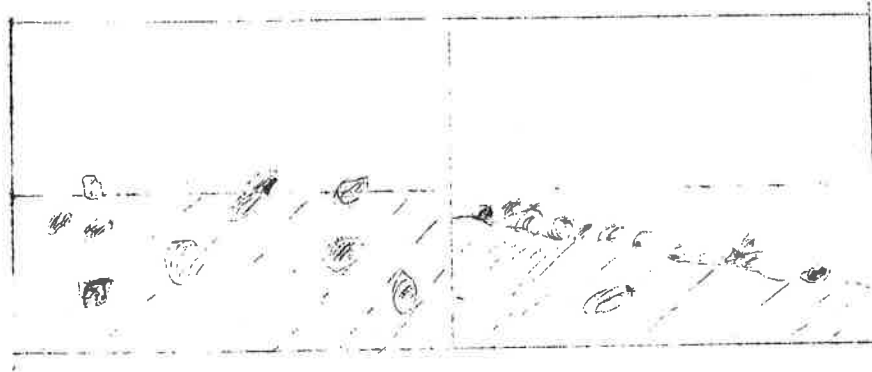


Fig 4. The Formation of Erosion Pavement.

2. Vegetation growing on pedestals or conversely covered by soil and debris.
3. Drifting soil, blow sand and dunes, (In some soil types and climatic regions this may be a natural phenomenon).
4. Sheet erosion.
5. Gullies— particularly those known to be of recent origin.

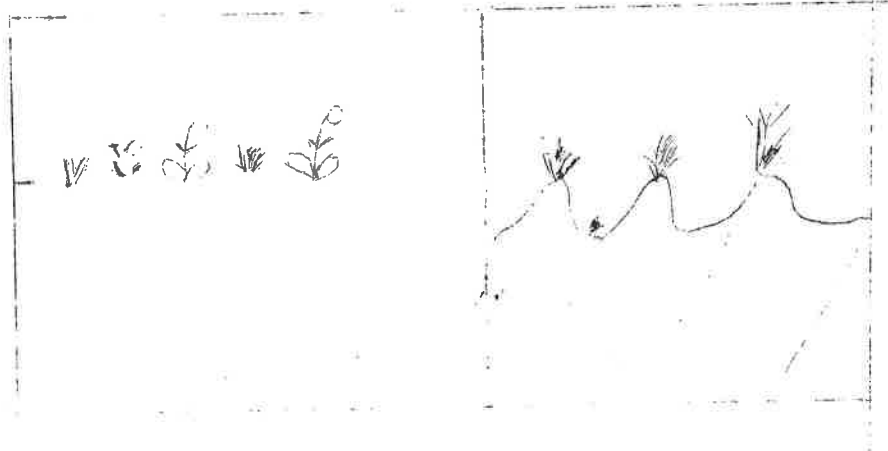


Fig. 5. Erosion. Formation of Pedestals.
Plants appear to rest on pedestals when unprotected soil around them erodes.

A word of caution in the employment of erosion as an indicator of overgrazing is pointed out as follows: The use of erosion as a grazing indicator is full of chances for error. Any attempt to correlate present erosion with present grazing is especially difficult. Two generalizations will be found helpful: (1) Distinct increase in number of recent gullies certainly indicates a "slipping range"; and is frequently but not invariably one of the later stages of overgrazing; (2) failure of vegetation to reclaim very small gullies resulting from past abuse also is a hint that recuperation has not yet begun--small denuded areas supporting little or no herbaceous vegetation may not indicate range abuse but rather a heavy soil content of gypsum or other salts unfavorable to plant growth.

In estimating the grazing capacity of a range the physical properties of the soil should be given consideration. Observation has shown that a degree of use on black grama, which would be destructive on the Jornada where the soils are sandy, would not kill out this valuable forage species where it grows on heavy clays or loams. As a rule, sandy soils should not be stocked as heavily as heavier soils with finer particles. Likewise, the plant cover growing on soils covered with rock rubble is less susceptible to injury from overgrazing than on soils which are largely free of stones. It has also been noted that limestone soils appear to withstand heavier grazing than non-lime soils.

In country of rough terrain closer attention should be paid to the condition of the flats, meadows, and valleys than to the adjoining slopes. After all, ungrazed or lightly used steep slopes are often accompanied by decided overuse in the more level areas. It is a mistake to attempt to secure full or even moderate use of steep slopes if this is to result in overgrazing the flats. Slopes above 50% should probably be regarded as waste range, so far as domestic stock is concerned, but may be used by wildlife species.

Length of slopes in this connection should be considered and may in itself be a limiting factor. Very short, steep slopes may be readily grazed by livestock, whereas, longer slopes with less gradient may form a natural obstacle to grazing animals.

Elevation as it influences climate, plant growth, length of grazing season, and range readiness should be kept in mind in regard to the use of the range. As an example of the effect of elevation on plant growth, blue grama growing at 8,000 feet may produce a good density, but the volume of forage available is usually extremely low when compared with blue grama stands growing at lower elevations.

The following statement of the effects of grazing upon water resources in the multiple use of wild lands, is taken from a paper prepared by Mr. Charles A. Connaughton* in the Journal of Forestry, Volume 41, September 1943.

Forage and Water.

"Forage and its utilization in relation to water is probably the most important single aspect of multiple use of western wild lands. This is because, first, forage is economically produced and harvested on most of the important water yielding lands; and second, forage utilization by grazing has probably adversely influenced the usability of water from western watersheds

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more than any other use. The reason for the latter are as follows: (a) where forage production prevails as an important use the physiographic balance is often delicate and easily upset by grazing thereby causing serious watershed damage; (b) the harvest of forage is on an annual basis and often for a considerable period of continuous use each year, thereby subjecting the watershed to frequent and prolonged opportunity for damage; and (c) localized misuse of forage and attendant watershed damage occur rather easily, jeopardizing the utility of an entire watershed.

To illustrate the first of these reasons, the vast semi-desert areas of the upper Colorado River in Wyoming, Colorado and Utah may be cited. Here the soil is extremely susceptible to erosion and although the plant cover is sparse, its grazing value is very essential to the regional economy. With these circumstances grazing is widespread and unless well managed, it can and does easily cause serious watershed damage. As an illustration of the second reason, any portion of the 728 million acres of western range land can be cited. Almost without exception, grazing animals visit each acre of this land each year. This means that the land is being used almost continuously in terms of an annual harvest and that serious damage is likely if there is the slightest lapse in management practices. The last reason can best be illustrated by the striking example along the Wasatch Front in Utah, where denudation of only a few hundred acres by overgrazing on the headwaters of several streams resulted in devastating floods, causing more than \$1,000,000 damage during the ten-year period prior to 1934.

In the main, the relation between forage and water is such that proper management for forage yield is also good management for water yield. Under special conditions, however, where the physiographic balance is very delicate, forage utilization may not be compatible with satisfactory water yield, and in these cases total exclusion of grazing is necessary. Generally speaking, forage utilization does not appear to offer as great an opportunity as forest utilization for improving watershed conditions but, over most of the west, grazing is practicable and if properly done causes little watershed damage and may even enhance watershed utility."

The above citation is used here to present the effect grazing might have on some of our mountain top parks which protect the watersheds of many streams, furnishing irrigation water for the valleys below. To show the importance of regulated stream flow, in many of our national parks we have established cooperative snow-survey courses to estimate the water content of the yearly snowfall so that farmers and other cooperating government agencies can judge the amount of water they will have available for crops and other uses. If these high mountain meadows and watersheds are excessively grazed we can see the effect it will have not only on part values but on the welfare of the entire community.

How Can We Best Protect Our Forage Resources

In discussing the protection of our forage resources, not only on the basis of domestic livestock grazing, which we tolerate because of existing conditions at the time the areas were set aside, but also from a wildlife standpoint, it may be necessary to repeat some of the information already given and such repetition is merely for the purpose of further clarifying and emphasizing the need for proper management of these valuable resources.

The keynote to all range restoration programs is proper stocking. It may not always be easy to accomplish this aim, especially where wildlife species are concerned; such as the elk problem in Yellowstone and Rocky Mountain National Parks.

In the case of recreational uses of the national parks where large numbers of saddle and pack horses are pastured, on camping trips and around headquarters, the forage is being over-utilized, resulting in some cases, in the drying up of the smaller mountain meadows, allowing lodgepole seedlings to come in to such an extent that the meadows are almost non-existent, or produce so little forage that they are practically useless as pastures. In other cases, the use by recreational stock interferes with the native wildlife species such as the Bighorn sheep in Glacier National Park. This problem of proper use by the horses of recreational parties will require careful study in working out a satisfactory solution. In some cases, such as are mentioned in Sumner's report on the Kings Canyon National Park, it may mean limiting the use to one night in some of the smaller meadows and changing the location of certain drift fences and the elimination of others.

It may mean that in some instances where large pastures are used exclusively for saddle horses, these horses may have to be kept up and fed hay and grain instead of pasturing in areas where the forage is needed for wildlife. In many cases the feeding of hay and grain not only saves the forage for wildlife but also keeps the horses in much better condition to carry on their work. This may result in some inconvenience and added expense for the park operator and even to the 'Service' itself, but will usually result in improved management in the long run. The importance of this type of grazing use in our parks and monuments, particularly in the west, is becoming more apparent in recent years and will require careful study and planning. It should be taken into consideration whenever we are asked to extend the grazing of other domestic livestock in the National Park Service areas, and often precludes the use of forage by additional livestock.

In other areas where the grazing of livestock is carried on under permits inherited when the areas were established or has been extended or introduced due to the war emergency, we still have the question of proper protection of the ranges and forage resources and in many cases restoring the ranges to somewhere near their original carrying capacity.

Here again, the keynote is not only proper stocking as to numbers of livestock, but also proper distribution on ranges already fully stocked.

In judging carrying capacities, forage production and utilization is the background of proper management. It should be remembered that a certain amount of forage is required for the maintenance of the livestock and if our ranges are producing only enough feed to maintain the stock in a fair condition we should look for remedies. The answer is usually found in lighter stocking so as to leave at least 25 per cent of the forage on the ground at the end of the grazing season. A good general rule to follow in the use of seasonal ranges is: (a) forage on early spring range should not be used more than 50 percent, in order to prevent overgrazing. This is because the new forage is lacking in strength and it takes more of it to furnish as much nourishment as older more mature forage. Also, the ground is usually wet and easily trampled, which causes the destruction of much feed when large numbers of livestock are admitted to the allotment too early; (b) average summer range may be utilized

up to 65 percent of the available forage without damaging the range; leaving 35 percent on the ground to mature and produce seed; (c) average fall and winter range may be utilized up to 75 percent of the available forage without damaging the range as by this time the forage is mature and the ground is usually frozen so that little damage is done through trampling.

On year-long ranges this rule will vary with the locality, forage type, climatic conditions, and other factors. However, if at least 25 percent of the current year's forage remains on the ground at the end of the growing season, the range as a rule is not endangered. In checking range use we may define Proper Use as the degree of grazing that will allow the more palatable forage plants to maintain density and vigor, prevent run-off and erosion, and minimize damage to tree reproduction./5.

Proper use necessitates lighter grazing on steep slopes, highly erosive soils, or deteriorated ranges than would be permissible under more favorable conditions. On range areas properly utilized, unpalatable shrubs and weeds are seldom, if ever grazed.

An individual plant can withstand occasional heavy use if it is allowed a sufficient resting period for the manufacture and storage of food within its stem bases and roots necessary for future growth. On the other hand, if the plant is continually and repeatedly closely grazed, forage reproduction declines and the death of the plant ultimately results. Experimental studies have shown that the amount of herbage produced when a plant is properly grazed from year to year will greatly exceed that produced under conditions of heavy use. Proper use to the stockman means, more grass, more meat, and more money. To the National Park Service it means maintaining our range areas in as nearly a natural condition as possible.

It has been determined through intensive studies under experimental control and from extensive records of stocking rates and range conditions throughout eastern Colorado that $1\frac{1}{4}$ to $1\frac{1}{2}$ inches of leaf stubble should remain on short-grass ranges when the forage has been properly used. Removal of a greater amount of blue grama and buffalo grass will eventually result in loss of plant vigor, disappearance of other palatable grasses and herbs, accelerated erosion, and decreased gains of livestock. /6.

When To Check Utilization.

The range or pasture should receive periodic inspection as a means of ascertaining the full degree of use of the important forage plants. A check is desirable on summer ranges as the growth of the forage is well developed at that time. The utilization check at the end of the season, however, is the most important of all. The final check on summer and fall ranges should be made as late in the fall as possible, even though grazing is not yet completed. It should be made early enough to avoid snow covered ground. Ranges grazed in the winter should receive their final check just before new growth begins in the spring. On year-long ranges, checks should be made periodically and especially at the time the forage growth starts, which in some cases may be after the summer rains, as many of the southwestern ranges are dormant during the dry summer and starts new growth in the fall after the late summer rains.

In checking utilization it is well to make observations other than stubble height. The soil should be observed for evidences of accelerated erosion;

at least one-fourth of the seed-stalks of grasses should remain at the end of the grazing season. If palatable shrubs are present, the twigs and leaves produced during the last growing season should not be grazed on the average in excess of 20 to 30 percent of their length. Some of the current twig growth should be entirely un-grazed and none of the woody growth of previous years should be used. Bunch grasses on the range or pasture should not be eaten below a stubble height of less than 4-6 inches.

Distribution of Stock on the Range.

Proper distribution of livestock on the range is an essential part of any management plan and may be secured through proper salting practices, water development, fencing, and through careful attention by riders.

The control of livestock through proper salting is one of the better methods of securing stock distribution and utilization of forage, and is also one of the hardest to put into practice. It is common practice among stockmen to place salt close to streams or water places; usually due to the long-time theory that a "cow has to have a drink when she licks salt." One old-time cow man told me, "My daddy salted cattle here for 35 years and what's good enough for him is still good enough for me." Salt may be placed at a distance of one-half to three-fourth of a mile away from water and the stock will get sufficient quantities of both salt and water and will not crowd around the water hole and salt block, thereby tramping out a lot of vegetation. Salt may be placed on open ridges or slopes where the stock are not utilizing the forage. An example of this was apparent at the Grand Canyon National Monument in 1942, when stockmen turned their cattle into the Toroweep Valley allotment, placing the salt within a few hundred feet of the watering place. When questioned by the ranger in charge, the owner gave the old answer that "a cow has to have a drink when she licks salt." After the stockmen had left the area, the ranger moved the salt ground to a spot about three-fourths of a mile away where the cattle had not been utilizing the vegetation. The result was very gratifying in that the cattle utilized the forage they had not been getting and at the same time were able to obtain sufficient amounts of water and did not tramp out the already sparse ground cover near the 'tank'. The stockman apparently approved as he placed the next load of salt in the same place the ranger had moved the former load. As the old saying goes, "It's hard to teach an old dog new tricks!" Likewise it is hard to get the older stockmen to realize the benefits to be gained through these changes in management practices.

Better distribution of stock on the range through the development of new watering places and the improvement of existing facilities is important, especially in the semi-desert and arid sections of the west and southwest. In much of the west and southwest, water is the controlling factor in the use of the range, and there is usually some overgrazing around existing watering places which cannot be avoided but should be held to a minimum. During hot weather, cattle in rough country, seldom travel over one to one-half miles from water, and during cooler weather they will generally go one to three miles from water. There are some exceptions to this rule, however, in the desert regions in southern Arizona, cattle have been known to travel up to ten and fifteen miles to water, watering only every other day. This usually occurs only during the driest years when water facilities are at the lowest.

In Organ Pipe Cactus National Monument, in southern Arizona, in September, 1942, I actually saw cattle going ten and more miles to get water. They would

come in to water from sundown until almost sunrise ~~the~~ next morning. Cattle travelling this far to water do not gain in weight and the vegetation certainly suffers from both trampling and over-grazing in the vicinity of the watering places.

Water development is one phase of proper distribution of range livestock that cannot be overlooked if we are to protect the ranges in the dry arid sections where the type of vegetation and soil are such that the heavy over-use around existing watering places is very destructive to the vegetation.

In considering water developments, especially earth 'tanks' or 'charcos' in a hot dry climate, it is necessary to take into consideration the high rate of evaporation of the stored water as well as the daily needs of the class of livestock using the area. Cattle and horses usually require 8 to 10 gallons of water per day during hot weather and sheep and goats 1 to 6 quarts. For practical purposes, it is considered adequate to figure 10 gallons of water per day for cattle and horses and 1 gallon for sheep. Watering places should be placed close enough on the range that stock will not be crowded together and they can obtain water at a maximum distance of 3 miles.

Fencing

The construction of good fences is one way to secure proper distribution of livestock on the range. Fences may be boundary fences, interior fences for the purpose of utilizing certain ranges at a specified time of year, or for pastures for special purposes such as holding the breeding stock separate from the remainder of the herd, and for many purposes. Drift fences may be built to control the movement of stock from one range to another, and for many purposes all of which go toward better management of livestock on the range.

Fences should not be constructed on slopes where stock trailing along the fence may cause gullying by water running down the trails. Interior fences may be used for the deferred-rotation method of grazing, and for seasonal use of forage.

Proper Class of Stock.

The range should be studied carefully to determine the proper class of stock to be grazed as well as the season of use. For example, a range upon which browse and weeds predominate should be grazed by sheep, whereas, a range which is predominantly grass, with few weeds of browse species present should be used by cattle and horses. Continued use of a given range by the wrong class of stock will eventually result in the depletion of ground cover and serious erosion problems.

The problem of 'dual-use' might well be considered at this time. There are those who advocate dual-use of the ranges; that is, the grazing of both cattle and sheep on the same allotment at the same time. Generally speaking, the forage preferences for cattle and for sheep differ somewhat. Cattle generally prefer grasses to browse and weeds, although at certain times of the year they do considerable browsing, while sheep prefer browse and weeds but also utilize some of the grasses. When both classes of stock are grazed simultaneously on the same allotment, they utilize the same species to some extent, and generally speaking, it is the better grade of forage that is

preferred by both classes of stock, thus leaving the poorer grasses and weeds to mature and re-vegetate the area.

A better solution to this problem appears to be a system of grazing whereby the class of stock using a certain allotment may be changed every three to five years. For example, a range used year after year by sheep will eventually lose some of the more palatable species of weeds which are replaced by grasses and will not be so useful as a range for sheep, if this range could then be grazed by cattle for a few years the composition of the forage would change back to a mixed grass-weed type better suited for sheep. The changing of the class of stock every few years would benefit the range, but it is not so easily carried out for various reasons. In the first place, the stockman cannot afford to change over from sheep to cattle and vice-versa, every few years without serious financial loss, then too, an allotment which has been developed for cattle, usually is not suited to sheep, because of water developments and other factors entering into the use of the area. However, this phase of range management has merits and should be considered for further study and research as to where it may be applied.

Dual-use may be considered on some allotments in the manner in which the area is utilized by seasons, for instances, in some of the southwest where sheep are grazed during the winter months when the forage has matured, the same area may be used by cattle in the fall or late summer without too serious damage to the forage. This method must be carefully watched, however, as too long a season of such use might prove detrimental to the range.

Erosion Control.

The most generally recognized cause of range deterioration is over-grazing and depletion of the ground cover. Continued heavy use of the range results in the destruction of the forage, which in turn causes washing and blowing of the soil, resulting finally in serious erosion problems.

The first step in any soil and moisture conservation program is proper stocking and utilization of the forage resources; reducing the number of live-stock to, or even below the normal carrying capacity of the range before any range recovery and erosion control projects are started.

As long as the range is overgrazed, without any effort being made to control it, little can be done toward the control of erosion and re-vegetation of the area.

It has been found through practice that artificial re-seeding of the western range lands is generally not a satisfactory method and that natural re-vegetation through proper range management practices is the most logical method of controlling erosion.

The control of stock through fencing and water development are the two most practical means of range control. If livestock can be excluded from overgrazed ranges until the forage has a chance to become re-established, it will aid in erosion control.

Erosion in small gullies may be retarded through the use of small check dams and spreaders which slow the water and allow it to spread over the surrounding ground surface thereby furnishing much needed moisture for the

vegetation and preventing the formation of large streams of run-off water which may do a great deal of damage to the range. Contour furrowing may be used in checking run-off and encouraging re-vegetation of the area. A good example of this type of work is the contour furrowing at Chaco Canyon National Monument, New Mexico, which is already producing results in increased vegetation along the furrows and the checking of the run-off after storms.

In many of the high mountain meadows of our National Parks, there is much damage by the trampling of the soft ground by cattle and horses, which in turn causes small streams to form which, if not checked, form deep gullies, draining the moisture from the surrounding soil leaving a dry site which invites the invasion of the meadows by the poorer grasses and even brush and trees. This may result in the invasion of the meadows by trees to the extent that their value as grazing land is destroyed and the scenic value is lowered through the ecological changes in the vegetation.

Often-times, a few logs, brush, and even rocks may be used to check these small streams and gullies, causing them to re-fill and raise the water table, which in turn results in the better forage plants re-claiming the meadows.

In most cases, the proper stocking, proper season of use, better distribution of stock through fencing and water developments will prevent serious erosion problems. Whenever it is noticed that the vegetation fails to reclaim even the small gullies something must be done and usually the answer is reduced numbers of livestock or exclusion of stock for certain periods until the forage has a chance to mature.

Drought.

Long periods of drought which occur at more or less frequent intervals have a decided effect upon the amount of vegetation produced on the ranges under continual use.

The range which may be able to stand up fairly well under average use during normal years will often-times be severely affected by drought in addition to heavy grazing use. A reserve of forage should be built up by proper management during the normal or good years, which will help to tide the stockman over the dry years when little forage is produced. The combination of heavy stocking plus drought will ruin a good range in one year. Many stockmen are prone to blame 'the drought' for everything. One man who would not be convinced that there was anything to this business of overstocking, and all his troubles were brought about through the drought was finally convinced through the efforts of the ranger who had been trying for years to put across his range management program. One day while the two were riding the allotment the ranger rode up to an old homestead which had been abandoned but still had a fairly good fence around a portion of it. The grass on the inside of the fence was considerably better than that on the outside where the cattle had access to it every season. The ranger stopped, and lighting up his pipe, said "Well, Bill, it looks like the rain must have stopped at the fence line." The stockman puffed a while and then remarked, "Well, now maybe them critters did have something to do with it."

Very few stockmen will ever admit overgrazing a range and many use the phrase, 'A good wet year will fix everything.' This discussion will serve to point out that drought in connection with heavy use is very detrimental to

heavily used ranges. Generally speaking, it is difficult to place all blame on any one factor but a combination of factors usually result in range deterioration. We must remember too, that range restoration takes much longer than range destruction.

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