How to get
SUSTAINED FORAGE

Production in Grazing Semi-desert Mixed Grass Ranges

By MATT CULLEY, Associate Range Examiner[1]
Southwestern Forest and Range Experiment Station[1] Forest Service

RECALLING conditions on the ranges of the Southwest during my own life of association with them, as well as going back still farther into the past with some of the old-timers and listening to their stories of range conditions of 50 or more years ago, brings to mind realization of the fact that many changes have come about with the passing years. Large areas that once supported abundant stands of forage have been reduced to a condition that only too often is the cause of considerable concern regarding the feed supply.

Many reasons have been given for this generally lowered supply of forage. Some attribute it in certain localities to the early-day operations of the fly-by-night speculators who descended with large numbers of livestock upon the unfenced ranges of legitimate stockmen and literally cleaned them out. Some contend that lack of control over the ranges by the stockmen was an important factor. Others feel that fencing the ranges in later years brought about range injury by reason of the fact that cattle were then confined to limited areas the year round, in contrast to drifting over the ranges and using the various parts only at seasons when they should be grazed. In many quarters homesteaders are blamed for coming in and plowing up the ranges, thus ruining the grass sod that formerly covered them. Still others contend that generally lowered rainfall, as compared to the early days, is a primary reason.

There seems little foundation for the latter belief, but in various degrees the other reasons undoubtedly contributed, along with the fact that there was a period when there were far too many cattle on the ranges.

Beyond these there is perhaps another contributing cause in that stockmen, as a whole, are, and always have been, an optimistic lot, ever looking for better times in the form of more rain and higher prices and ever trusting that Nature would heal whatever scars grazing and drouth might leave on the ranges. There is little doubt that this "perennial optimism" of the stockmen (as the late C. M. O'Donel called it) frequently led to overtaxing the resources of the ranges. This thought was emphasized by Frank Boice (at the 1935 Arizona cattlemen's meeting in Globe) when he made a statement to the effect that stockmen during the good years too easily forget the trials and tribulations that come with the more numerous drouth years. Harry Saxon and others have frequently voiced similar thoughts and emphasized the need for stockmen to cut down in drouth times and build up their herds slowly afterwards, so that the range might have a chance to fully recover from the effects of drouth.

Whatever may have been the cause of the lowered range capacity matters little now, except as it might suggest changes toward better management of range lands in the future. The real problem before stockmen today is the rebuilding of their ranges, in order that they may have something worthwhile to pass on to their sons and daughters, upon whose shoulders will rest the responsibility of perpetuating an industry that—despite the hardships encountered—has been built up by the stockmen to occupy an important and permanent place among the industries of the region, and for that matter, the country as a whole. That there is much yet to be learned about range management and many vital problems still to be solved, few will deny. Aside from the school of practical experience, range research should undoubtedly play an important part in the development of plans for the future handling of our range resources.

VALUE OF RESEARCH

Range research entered the picture in the late 1890's and has since endeavored in various ways to aid in a program of practical range use through a study of the many factors that affect the growth and management of range forage plants. One such endeavor was started on the Santa Rita Experimental Range[2] in 1925, with the following three main objectives:

1. To determine what degree of use the more important semi-desert grasses of southern Arizona can endure without reducing their stand and yield of forage.

2. To determine what effect deficient rainfall has on the maintenance of the stand and yield of these grasses.

3. To work out a satisfactory basis for estimating sustained grazing capacity of the semi-desert grass ranges.

In this experimental work, two areas of typical semi-desert grasslands were chosen and fenced against cattle grazing. Both of these areas supported a good stand of grass as a result of having been moderately grazed for a number of years previous. Within each area a number of small plots were laid out and artificially cropped with an ordinary pair of large shears. On some of the plots the grasses were frequently cut down to within one inch of the ground to simulate close and continual grazing; while on others they were clipped two inches above the ground at recurrent intervals, to represent more nearly conservative or proper use. Six important grasses common throughout southern Arizona were studied, namely, rothrocks, black, slender, hairy, and sprucetop gramas and curly mesquite. The cropping was continued throughout the summer growing season for nine successive years, including 1933. The results of the two methods of cropping were measured in terms of changes in the stand (expressed as per cent of ground cover) and in yield of forage (expressed in pounds of dry weight of forage clipped off).

It was realized at the outset of this study that artificial cropping would not be exactly like grazing by cattle. It was felt, though, that certain useful information pertaining to the growth and yield of grasses could be obtained in this manner. Range conditions in 1925 (the starting year) were abnormally poor, following the extreme drouth of 1924. Beginning with 1925, there was a 7-year period in which the rainfall was on the increase up to and including 1931; then followed a 2-year period of greatly lowered rainfall, marked by a drop in precipitation from about 29 inches in 1931 to 14 inches in 1933. The average annual rainfall on the Santa Rita is about 15 inches.

CLOSE CROPPING BRINGS INJURY TO RANGE

The results obtained on the plots that were kept closely cropped (1 inch from the ground) plainly showed that such a practice on semi-desert grassland range would lead to range injury in the following ways: (1) As compared with conservative cropping, it very materially reduces the stand of grass; (2) it greatly lowers the yield of forage; (3) it leads to more rapid washing away of the good topsoils; and, finally (4) it results in a relatively high average carrying capacity. All in all, this degree of use seemed to approach what might be called conservative or proper use for all grasses except black grama, for which a more conservative degree of use seems necessary, possibly not closer than 3 inches above the ground.

CONSERVATIVE CROPPING FOR PRODUCTION

The serious effects of continual close cropping on the grass stand began to show up definitely in the fourth year, when the density (on plots so clipped) dropped below that of the 2-inch cropped areas, as is shown in Figure 1. From 1928 on, the stand under conservative cropping averaged about 66 per cent thicker than that maintained under continual close cropping. The practical value of these results is shown in the yield of forage which, after all, is what determines the capacity of the range to carry cattle and produce beef.

The adverse effects of continual close cropping on forage yield began to show in the second year, when the yield of these plots (after starting at a higher level) dropped below the yield cut from the conservatively cropped plots (see fig. 2). On the average, *conservative cropping gave 90 per cent more feed than*

[1]Maintained at Tucson, Ariz., by the Forest Service, U. S. Department of Agriculture, in co-operation with the University of Arizona, and covering the States of Arizona, New Mexico, and western half of Texas.

[2]Branch of the Southwestern Forest and Range Experiment Station near Tucson, Arizona.

Reprinted from the Western Livestock Journal, issue of April 27, 1937

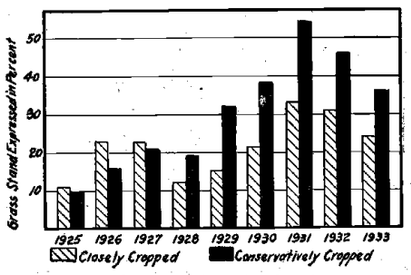

FIGURE 1.—*Comparative stands of grass under close and conservative cropping. In the long run, conservative cropping increases the grass stand and forage supply, and builds up reserve to meet the stress of dry years. Note that in the years following 1928 the stand of grass under conservative cropping was materially thicker than under close cropping, averaging about 68 per cent better.*

close cropping. It is interesting to note in Figures 1 and 2, that the first evidence of injury from close cropping showed up in lowered yield of forage, and that the stand was not adversely affected until the fourth year. This clearly shows that close cropping injured the grasses in sufficient degree to cause an early reduction in the yield of forage, but that it was several years before injury was sufficiently great to cause lowered density. This is a significant point, and indicates that range injury from either overgrazing or drouth conditions cannot easily be recognized until the measure of damage has progressed to a serious point. It can also be clearly seen from Figures 1 and 2 that, following the drouth of 1924, the grasses recovered much more rapidly under conservative cropping than under close cropping.

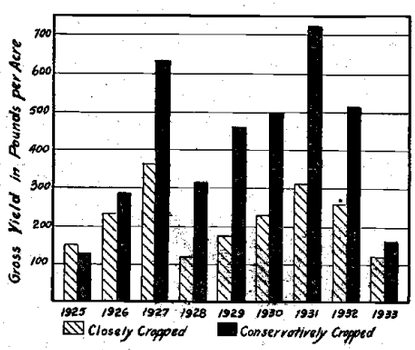

FIGURE 2.—*Relative yield of forage under close and conservative cropping. The latter resulted, on the average, in the production of 90 per cent more feed.*

It may be argued that under actual range use cattle will not graze in a conservative manner such as is indicated here as desirable. However, continued watching of cattle on the range has shown that when feed is plentiful they naturally tend to graze only portions of grass clumps and miss many altogether. Rarely do they graze as closely as 2 inches. On the other hand, when feed is short they tend to graze closer than 2 inches. This means that with proper numbers of cattle, well distributed, forage use would automatically be much nearer the desirable standard indicated in this study.

Naturally, close grazing in drouth years is often difficult or impossible to avoid; but if confined to occasional very dry years, with a definite effort to provide for moderate use in the years immediately following, there is little likelihood that permanent injury to the grasses will result. The truth of this statement is strikingly brought out in Figure 2, where the yields (following the drouth of 1924 and 1928) rapidly rose to a high level under conservative cropping and, although improving, remained relatively low under close cropping.

RAINFALL A VITAL FACTOR

Everyone knows the value of effective rainfall on semi-desert grasslands. The cattlemen know also the serious problem of short feed that accompanies prolonged drouth periods. Just how rainfall affects both the grass stand and forage yield—even under conservative use—was clearly demonstrated in this experiment. The relationships are shown in Figure 3, in which both the stand and yields of grasses are expressed as per cents of the 9-year averages, in comparison with annual rainfall. This Figure shows the following facts: (1) From 1925 to 1931 the stand and yield of forage improved with upward trend in annual rainfall; (2) the yield of forage dropped from the highest point in 1931 to a very low point in 1933, as the result of greatly reduced rainfall; (3) in 2 years out of 9, the forage yields were high, in 3 of the years the yields were about average, but in 4 of the years the yields were very low.

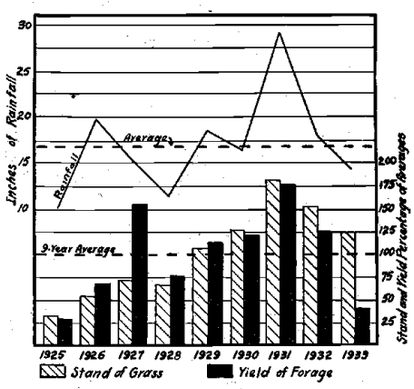

FIGURE 3.—*Annual fluctuations of grass stand and forage yield in relation to variations in annual rainfall. Gradually increasing rainfall for the first 7 years was accompanied by increases in stand and yield, whereas, decreasing rainfall following 1931 resulted in reductions of both stand and yield of grasses.*

The practical significance of these findings is that where stocking is based on the amount of feed produced in the good years, in 4 years out of 9, there will be feed shortage due to a combination of drouth and close grazing. Provision for these short-feed years is the real problem that stockmen are up against.

PROPER BASIS OF STOCKING

If the annual rainfall were more or less uniform from year to year, stocking on the basis of the average yield of forage for a period of years would be possible and would offer distinct advantages from a management point of view. But as the annual rainfall cannot be controlled, other ways must be found to meet the problem of the ever-recurring dry years. Stocking on the amount of feed produced in an average year was tried on the Santa Rita Experimental Range for a period of 8 years (1922 to 1929), but it proved to be considerably too high. Consequently, in the 6 years following this trial, the numbers of cattle were reduced 15 per cent. This basis of stocking proved to be satisfactory until the prolonged drouth of 1932, 1933, and 1934, when again the rate of stocking seemed slightly too high.

During the latter period, the results of the cropping study became available and, when considered along with the actual grazing results, clearly showed the reason for the failure of the first basis of stocking and at the same time indicated the need for a slightly more conservative basis of stocking than was followed during the second trial. These results are shown in Figure 4, in which the actual yields[3] of feed under conservative cropping are given. From this Figure it can easily be seen that if the moderate to serious feed shortages range were stocked on the basis of the amount of forage produced in the average year there would be 4 years in which would result. In 1925 the yield fell short of the average by 286 pounds per acre, in 1926 by 129 pounds in 1928 by 96, and in 1933 by 252 pounds per acre. If the sum of these forage deficiencies for these 4 years were spread over the entire 9-year period the average year's shortage would amount to about 85 pounds, or approximately 20 per cent below the forage yield of the average year. In this way the safety factor of 20 per cent was arrived at, and is what is shown as the "proper basis of stocking" in Figure 4. When such a basis of stocking is followed, there would remain only 2 years in which serious shortages of feed would occur. Under actual grazing conditions, the shortages in these 2 years would probably not be so great as shown here, for the simple reason that with moderate stocking in the good and better years there would be unused feed left over and available for use along with the new feed produced in drier years. Observations made in this study showed further that with more moderate use in the good years the amount of feed grown in the dry years was relatively high, when compared with that which was produced under continual close cropping (see fig. 2).

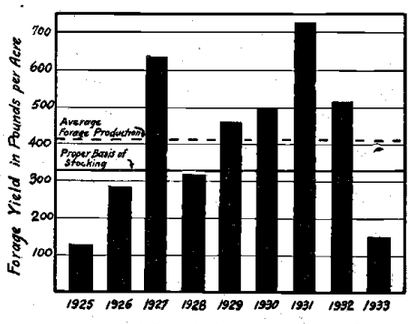

FIGURE 4.—*Yield of forage in pounds per acre in relation to the 9-year average and also in relation to a basis that is 20 per cent below average, the latter representing the proper basis of stocking on semi-desert grassland ranges.*

These long-time pasture studies, coupled with the results of the intensive cropping study, furnish a reasonably sound basis for recommending that the proper numbers of stock for any particular range should be about 20 per cent below the number that the range could carry in an average year.

PROPER RANGE-USE

The results of the 9-year study on the Santa Rita, when translated into a safe and practical guide to the use of semi-desert mixed-grass ranges, show that:

1. On the average, most of the common semi-desert range grasses in southern Arizona can be grazed safely to within about 2 inches of the ground. Grazing any closer than this constitutes overuse and brings about a weakened condition of the grasses, ultimately causing serious reduction in both stand and yield.

2. Black grama is an exception to this rule, and apparently cannot be grazed closer than 3 inches above the ground.

3. In serious drouth years close use, if impossible to avoid, should be confined only to such years, with a definite attempt to moderate the use in good and better years. In this way permanent range injury will be largely avoided.

4. Deficient rainfall is a vital factor in reducing both stand and yield of forage; and when followed by continuous close grazing, results in abnormally large reductions in both stand and yield of forage, accompanied by slow recovery in the good years. Conservative use, on the other hand, minimizes the decline in stand and yield and enables relatively quick recovery following drouth.

5. Sustained or proper grazing capacity can be realized by stocking at a rate approximately 20 per cent below the capacity of the range under forage conditions of the average year.

Above all, it must be realized that Nature alone cannot heal the scars resulting from overgrazing and drouth, but must have the help of stockmen if the ranges are to be of greater profit to them.

[3] Yields given represent total amount of forage produced. Due to trampling, natural weathering, palatability allowance, and rodent use, only about 60 per cent of these yields actually become available for use by the cattle.