

## VALUES AND LIMITATIONS OF CLIPPED QUADRATS<sup>1</sup>

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Many investigators have used the clipping method to obtain data representing the effects of varying intensities of harvesting grasses and other herbaceous vegetation. The work of Sarvis ('23), Sampson and Malmsten ('26), and Aldous ('30) on range grasses; Ellett and Carrier ('15), Graber, *et al* ('27), and Stapledon and Milton ('30) on crop and pasture plants; and Harrison ('31) on the maintenance of turf on golf courses; illustrate the breadth of the field in which the method has been used. In range research, the yield and vigor of grasses under varying degrees of use have been the principal data desired to supplement actual grazing experiments. Many tests have shown the effects of various treatments upon the quality of the vegetation and also upon plant succession.

### METHODS OF CLIPPING

Clipping studies usually are established with a series of meter square or similarly sized quadrats with one or more forage species represented, and clipped uniformly at heights varying from 1 to 4 inches, and at intervals from every week to one cutting at the end of the growing season. The clipped vegetation usually is weighed both green and air dry, and samples are analyzed to determine the quality of the forage produced under the different treatments. The quadrats are mapped once or oftener each year to show the area changes of the plants.

### LIMITATIONS OF CLIPPED QUADRATS

Clipping studies serve as a valuable supplement to grazing experiments but their limitations must be recognized and given proper consideration in the interpretation and application of results. In crop and turf studies, the experimental results should be almost directly applicable in the field, but there are several points of difference between clipping and actual grazing by live stock, which prevent direct and unqualified application of the results in range management.

One of the principal differences between clipping and grazing is the manner in which the forage is removed. In clipping, the vegetation is cut uniformly over the quadrat at a given height, while livestock mainly pull

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and break off the flower stalks and leaves at a convenient height, which varies considerably with different species of forage or with different classes of stock. Whether or not there is a marked difference in plant reaction to injury by cutting or by breaking can be determined only by experiment. If studies are desired to simulate grazing, the solution may be found in harvesting the forage, not by cutting, but by pulling the leaves and stems in a manner as similar as possible to the actual grazing of the particular class of livestock for which the results are desired.

Another difference is that the natural preferences of livestock are not simulated in clipping studies, particularly where more than one species is involved in the same study. When range is conservatively grazed, the utilization by livestock is very patchy, with some small areas a few feet across, of vegetation eaten to within a few inches of the soil surface, and other adjacent small areas hardly touched. Also where there are several forage species on an area, one or more may be taken with relish to within one or two inches above the soil surface, while other species are eaten only sparingly to within 4 to 6 inches of the soil. On yearlong range, two or three species may be eaten only in the summer and autumn, while other species are relished throughout the year. These are features which have not been reflected in clipping studies, but which can be provided for if the purpose of the study is to imitate grazing as closely as possible.

Comparatively small quadrats are required for convenience in mapping and for accomplishing the measurements and clipping within a reasonable length of time. With plots as small as one meter square, there is some question as to the accuracy of results, unless the quadrats are selected very carefully. The error is reduced, of course, by performing the clipping on as many sets of duplicate quadrats as time permits.

The disturbance of both the vegetation and the soil on clipped quadrats is not comparable to that caused by the trampling of livestock on a grazed area. The borders of quadrats clipped most often may be well trampled by the worker, while vegetation on the plots themselves is not trampled at all, a situation which does not occur on grazed range. Furthermore, the effects of trampling by stock on different forage species and soil types can be obtained only on grazed plots. Even though it may be negligible on conservatively grazed range, trampling and its effects on reseeding and plant growth must be considered as a range factor not accounted for in clipping studies.

The accumulation of litter on clipped quadrats differs from that on grazed range. Clipping even once a season allows practically no leaves or flower stalks to drop to the soil surface, while under conservative or even full use of the range, considerable litter is contributed to the soil every year, and even more when the range use is deferred. The loss of litter permits erosion of the top soil away from the root crowns of the grass tufts and reduces the amount of moisture seeping into the soil. Continued erosion affects adversely

the yield of the clipped quadrats as was noted by Sampson and Weyl ('18) in studies of forage production on eroded and noneroded soils.

#### VALUE OF CLIPPED QUADRATS

The principal objections to the clipping method arise from the fact that it does not simulate actual grazing. Nevertheless, clipping studies offer the most direct and accurate method of obtaining, under definite control, results which show the actual yield of range and pasture plants, and the relationship of yield to moisture supply and intensity of stem and foliage removal. The value of the method in range research depends in part upon the purpose for which it is used. If data are desired which unquestionably reflect actual grazing, the method commonly used must be perfected to remove the limitations. Many of these questionable features can and should be eliminated in the future; but for the present, when cost is such an important item, facts of great importance in range and pasture management may be brought to light and put into use, if the true purpose and proper application of the results is understood clearly. Results showing the effects of degree and frequency of clipping and of rainfall on the yield, vigor and nutritive value of plants at different seasons of the year can be used as indications guiding and supplementing actual grazing studies and practice.

Clipping studies, carefully selected and conducted may show many desired relationships, some of which follow:

1. Forage yield each year over a period of years.
2. Variation in yield between species.
3. Relation of yield to soil moisture.
4. Relation of tuft area or plant cover to soil moisture.
5. Relation of both yield and tuft area to frequency and degree of harvesting.
6. Relation of height growth, leaf length, number of flower stalks and tuft area to yield.
7. Relation of nutritive and mineral values of clipped material to soil moisture and to frequency and degree of harvesting.
8. Probable trends in plant succession under different degrees of cutting.

One additional use of clipped quadrats is for the securing of data showing comparative forage production on large range units each year. Especially on winter or yearlong ranges, representative plots could be established, charted, clipped to appropriate height, and the resulting data used as an index of forage production. Under this system, the quadrats selected would be used for only one year with a new set located on representative areas of the range every year, because the reaction of the vegetation to complete harvesting would leave it in a condition unrepresentative of general production the following year.

## APPLICATION OF RESULTS

The most important problem in range and pasture management is the determination of numbers of stock that a given unit will support with sustained profit to the owner and with proper conservation of the resources involved. Assuming that proper class and distribution of livestock on the unit are in effect, the questions of proper numbers and season of use lead directly to the problem of proper forage utilization, which is: just how closely may the important palatable plants be grazed without impairing their growth, vigor, and future productivity. It is upon this important problem that clipping studies can show some very forceful indications. For instance, in 1915, it was thought that *Bouteloua eriopoda* in southern New Mexico could be maintained permanently when used each year to within 1.5 inches of the ground. Clipping studies on the Jornada Experimental Range have indicated however, that complete cutting at two inches above the soil surface is too intense under the rainfall conditions obtaining there. Similar studies with the same species on the Santa Rita Experimental Range, with higher rainfall than the Jornada, have indicated that clipping to two inches above the ground will permit maintenance of the species in many parts of Southern Arizona. Actual grazing practice has shown the truth of these findings. Thus, extremely valuable indications have been obtained as to what constitutes proper grazing of this important species in two different climatic locations. Further indications of adjustments in grazing practice are in view when final analysis of seven years results on the two studies is completed.

The findings of Sampson and Malmsten ('26) in Utah have led to greatly improved grazing practice on the National Forests. Their outstanding results were the determination of proper degree and frequency of grazing throughout the summer, the effects of seasonal harvesting, and the serious effects of too frequent harvesting of the forage, either in the early stages of development or after seed maturity. In addition, their results pointed out desirable tests to make under actual grazing conditions.

## SUMMARY

Clipping treatment may be applied to the field almost directly in work with field crops and turf. It fails to simulate grazing by livestock exactly, but in spite of the differences, many of which may be overcome, clipped quadrats when carefully selected and conducted, can be of immense value to actual grazing studies. Results can be obtained at rather low costs to show the comparative maintenance, yield and quality of forage species under known varying intensities of harvesting, with the effects of given amounts and character of rainfall upon production. The method already has aided greatly in the determination of correct utilization of range and pasture forage, a feature which is vital for the proper conservation of the forage and water-

shed resources. When used with perfected technique and judicious interpretation of results, it should prove to be even more valuable than it has been in the past.

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