A New Method of Determining Forage Cover and Production on Desert Shrub Vegetation

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Research into the utilization of vegetation by sheep and the nutritive content of the grazing sheep's diet on Utah's winter ranges from 1946 through 1948 by the staff of Utah State University led to the development and use of an improved method of sampling forage production in the saltbrush type of the northern desert shrub formation. (Green *et al.*, 1951; Sharp, 1949). This method is commonly called the "25-square-foot method."

It is the purpose of this paper to describe the method and present a preliminary evaluation of its field application.

The 25-square-foot method utilized the basic concepts underlying the range reconnaissance and square-foot density range survey methods (Stewart and Hutchings, 1936). It improves upon the former methods by use of a 25-square-foot plot frame sub-divided to facilitate plant cover estimating. The plot frame is mechanically similar to the coordinate method of mapping low shrubs (Pickford and Stewart, 1935).

The 25-square-foot method can yield information concerning plant density and forage production by species.

The equipment consists of a 25-square-foot frame (Figure 1) constructed of light steel tubing. The frame is hinged at the middle, so that it can be folded for easier carrying and is supported above the vegetation by six telescoping legs. Each leg is equipped with a lock screw and can be adjusted to vary the height of the frame from approximately 10 to 20 inches above the ground.

A sliding crosspiece, 1 foot wide and 5 feet in length, constructed of variously-sized welding rods is subdivided into 1/16-square-foot units. On a 25-square-foot plot, each 1/16-square-foot unit represent 0.25 percent of ground cover. The sliding crosspiece is used in five consecutive positions on the frame. The number of 1/16-square-foot units occupied by each species on each plot is estimated and recorded while observing the vegetation from directly above the crosspiece.

Forage production by each species can be determined by multiplying the number of 1/16-square-foot units occupied by each species by the average air-dry weight per 1/16-square-foot unit of that species. This average is determined by clipping, drying, and weighing a sample of the current year's growth from the species. The number of 1/16-square-foot units occupied by this sample is estimated and recorded prior to the clipping (Cook and Harris, 1950).

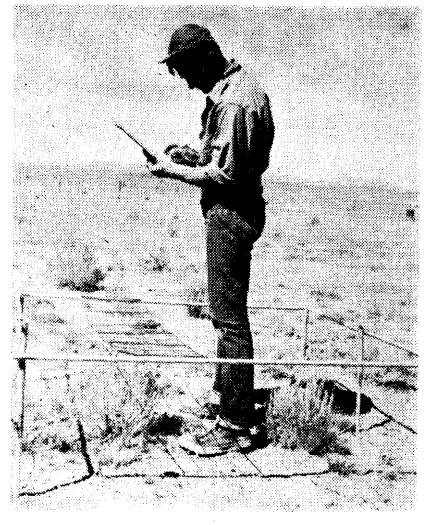

FIGURE 1. The 25-square-foot plot frame with the 5-square-foot sliding cross piece which was used to determine the percentage of ground covered by each species.

Methods and Procedure

Field Procedure

The study area was located in Curlew Valley, a typical salt-desert area in northwestern Utah.

The study was conducted on two pure vegetation types, shadscale (*Atriplex confertifolia*) and winterfat (*Eurotia lanata*). Field data were collected the fall of 1956, prior to the winter grazing season.

Thirty 25-square-foot plots were randomly selected in each vegetation type and three observers estimated each plot. Observer experience with the method varied. One had used the method for about six months, another briefly during the previous summer, and the third had had no experience. A short training period was conducted prior to estimating each type so that observers could compare estimates. After training, independent estimates were made by each observer. After all estimates for a given plot were recorded, the current growth was clipped from all plants. The harvested material was placed in paper bags for drying and weighing.

Office Procedure

The data collected were summarized and analyzed statistically to determine (a) the consistency among different operators estimating plant cover on identical plots, and (b) the relationship between the number of 1/16-square-foot units of plant cover and forage production.

The consistency of plant cover

Table 1. Analysis of variance for estimates of three observers on thirty plots of winterfat and shadscale.

Source of variation	Degrees of freedom	Mean squares
Shadscale		
Estimates	4	45.03*
Location	29	100.35**
Observer	2	0.22
Observer x estimate	8	0.58
Error	406	15.71
Winterfat		
Estimates	4	9.54
Location	29	47.91*
Observer	2	306.84**
Observer x estimate	8	0.27
Error	406	9.59

* Significant at the 5 percent probability level.
** Significant at the 1 percent probability level.

or density estimates by individual operators was tested by analysis of variance (Table 1). Simple linear regression was used to correlate estimates of cover with weight of herbage produced (Figures 2 and 3.)

Results and Discussion

Results from this study indicate that the 25-square-foot method is a useful tool for estimating plant cover of certain types of desert shrub vegetation.

Operators were consistent in estimating plant cover on shadscale, whereas, on winterfat they were more variable. (Table 1). In this experiment no significant differences were detected among operators' estimates of shadscale. For winterfat, however, the estimates of the three operators differed significantly. These differences probably were due to the inherent growth characteristics of winterfat plants which have irregular and poorly defined outlines. Shadscale peripheries are regular and well defined.

A definite correlation between plant cover estimates and herbage production was found. Figures 2 and 3 show the linear relationship between these two for shadscale and winterfat. The correlation coefficients for shadscale were highly significant for all observers. Actual variations in herbage production accounted for 90 percent or more of the variations in estimated plant cover. For each change of 1/16-square-foot in shadscale cover there was a corresponding change of 3.0 to 3.5 grams (95 percent confidence interval) of air-dry herbage production. Correlation coefficients for winterfat were significant for all observers. However, the correlations were not as high as those for shadscale. In this case only 44 to 60 percent of herbage production variations were accounted for by plant cover variations.

For each change of 1/16-square-foot unit in winterfat plant cover there was a corresponding change of 1.2 to 1.5 grams (95 percent confidence interval) of air-dry herbage production. It appears that the relationship between estimated plant cover and actual herbage is dependent upon the growth forms of the individual species.

In this experiment a series of entire 25-square-foot plots were clipped in order to measure correlations between plant cover and herbage production. Variability in growth forms among sites for a given species may necesitate measurements of correlations for each major area studied.

The subdivision of the plot frame into 1/16-square-foot units probably contributed to the observers' ability to estimate plant cover. The ability of men to agree upon density values for a given quantity of vegetation appears to increase with subdivision of a plot.

The method appears to be best adapted to intensive vegetation surveys on relatively small areas. Bulky equipment may restrict

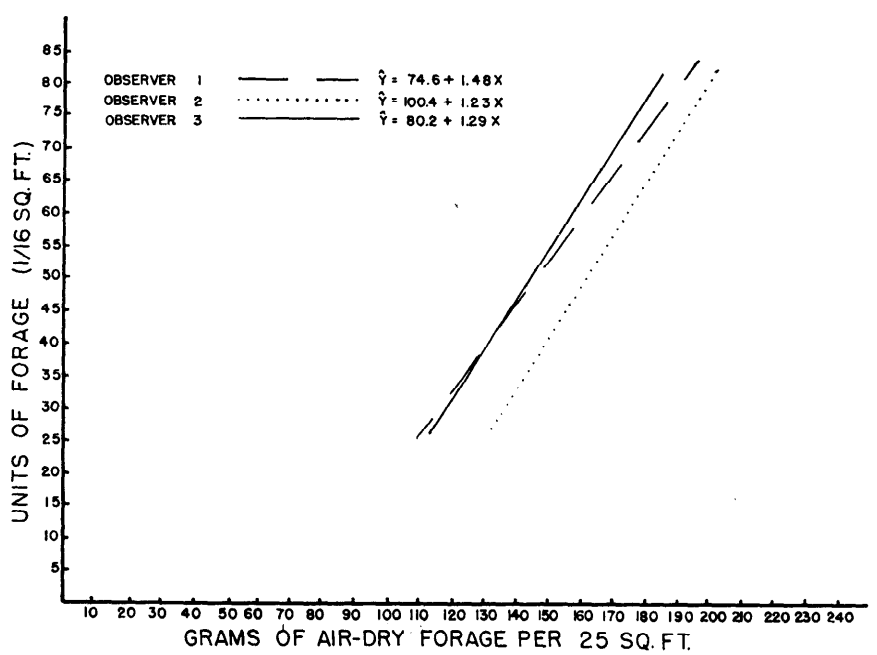

FIGURE 2. Regressions for three observers expressing relationships between plant cover and air-dry forage production (current year's growth) for shadscale.

its use in rough terrain which must be traversed on foot.

Summary

An improved method of sampling forage cover on desert shrub vegetation was developed by the staff of the Range Management Department of Utah State University. A study was conducted to determine the effectiveness of the method in obtaining a correlation of plant density estimates and forage production on two different vegetation types and the ability of three operators to obtain similar estimates of vegetation plant cover.

A significant correlation was found between plant cover and current forage production on both types of vegetation. Operators were found to be consistent in estimating density of shadscale, however, their estimates differed significantly in winterfat vegetation. This was attributed to the more irregular crown outline of winterfat compared to that of the shadscale.

The method appears to be a valuable research tool in estimating plant cover and herbage production. However, because of the bulky equipment that is used, it may be best adapted to intensive vegetation surveys on relatively small areas.

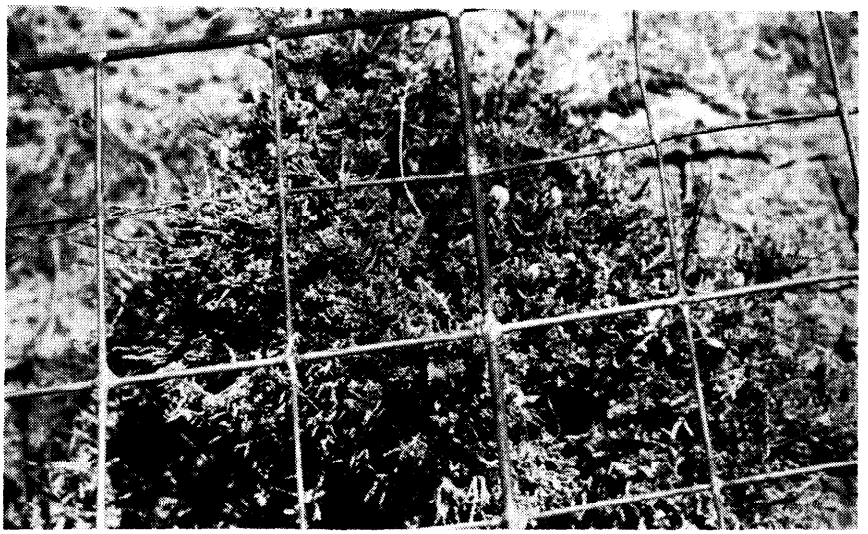

Figure 4. View of the 5-square-foot cross piece used to estimate the percentage of ground covered by each species.

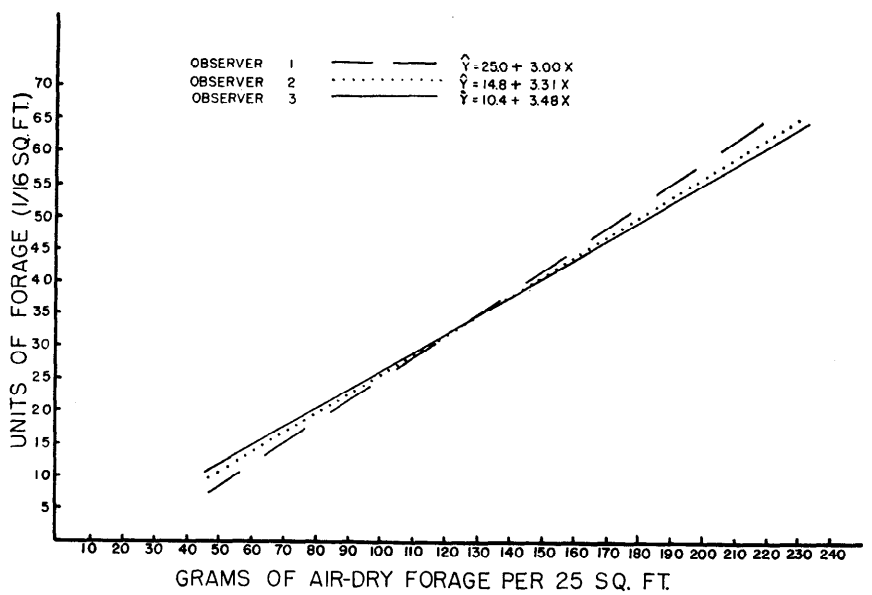

FIGURE 3. Regressions for three observers expressing relationships between plant cover and air-dry forage production (current year's growth) for shadscale.

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