Estimating Herbage Production Using Inclined Point Frame

EUGENE E. HUGHES

Range Conservationist, Agricultural Research Service, Los Lunas, New Mexico.

The point-frame method has been in use for several years as a tool in sampling range vegetation. Since its origin the point-frame has been studied (Drew, 1944; Goodall, 1952; Levy and Madden, 1933) and modified for use in various grassland types (Arny and Schmid, 1942; Heady and Rader, 1958; Merney, 1960).

Depending upon the type of information desired, the method is used in several ways. One method is to set the whole frame down, pins in place, and count the number of pins touching the various types of forage plants, recording them by species. Another use is to set the frame down, without the pins, then drop each pin into the frame, recording only a hit or miss regardless of the number of times the pin hits a plant. Another procedure is to record the number of times the pin hits the same plant as well as other plants as it passes down through the vegetation. The latter method estimates plant cover while the two former methods are a measure of plant frequency.

This study was carried out to see if there was a good relationship between plant cover, as determined by the latter method, and herbage production so that both could be obtained at the same time, thereby reducing effort and measurements in vegetation analysis.

Methods

Three grassland types were chosen for study: (1) a natural tobosa *(Hilaria mutica)*-buffalograss *(Buchloe dactyloides)* grassland with an overstory of live mesquite *(Prosopis juliflora var. glandulosa)*, (2) a natural tobosa-buffalograss grassland which had been deferred two years prior to the study after the mesquite overstory was sprayed for mesquite control, and (3) a mixed natural-reseeded grassland, a result of a rootplowing and reseeding operation to remove the mesquite and increase forage production with introduced grasses. The predominant native grasses were tobosa and buffalograss.

A random sample of 20 frames was taken with the inclined point-frame in each area. Each frame contained ten pins making a total of 200 sample points. After the frame was put in position, each pin was lowered separately and the total number of times each pin hit each separate plant was recorded by species. This was recorded as plant cover.

Table 1. Plant Frequency in Hits Per Two-Hundred Pins by Species.

Area	Bare Ground	Buffalo Grass	Tobosa Grass	Weeds	Annual Grass	Total
No-treatment	32	110	45	30	8	224
Sprayed	10	84	90	101	1	286
Rootplowed	27	56	24	39	113	259

Table 2. Plant Cover in Total Hits Per Pin by Species.

Area	Bare Ground	Buffalo Grass	Tobosa Grass	Weeds	Annual Grass	Total
No-treatment	32	303	238	33	13	619
Sprayed	10	287	441	157	1	896
Rootplowed	27	188	83	65	330	693

Table 3. Herbage Production in Pounds-Per-Acre by Species.

Area	Buffalo Grass	Tobosa Grass	Weeds	Annual Grass	Total
No-treatment	195	336	83	23	637
Sprayed	159	985	397	3	1544
Rootplowed	161	265	181	677	1284

Also, as each pin hit a species, regardless of how many times, one hit was recorded in a separate column. This was a measure of plant frequency or the number of times out of ten that a certain species was found. After all ten pins had been lowered, a 3.1 x 3.1 foot square frame was placed over the point-frame and all vegetation clipped. The clipped vegetation was then oven-dried to 110° C and weighed. Simple correlation analysis (Snedecor, 1956) was used to measure the relationships between a species frequency and its herbage production and between the same species, but using plant cover as a measure and relating it to herbage production.

Results And Discussion

Data on plant frequency, plant cover, and herbage production by species are presented in Tables 1, 2, and 3, respectively. Although the root-plowed area was reseeded, no hits of the introduced grasses were recorded in the sample due to a very poor stand on this area. The results of the correlation analysis, for each area, measurement method, and species, are shown in Table 4 and 5. Both plant frequency and plant cover appeared to give reliable estimates of herbage production for buffalo and tobosa grass although plant cover was a more reliable estimate of tobosa grass production. This was probably due to its growth form —long leaves and long, curving stems. These two species made up most of the plant population.

Although not evident in the vegetation analysis tables, the most abundant weed on the areas was annual broomweed *(Gutierrezia dracunculoides)*. This is a large, single-stemmed weed which does not contribute much to plant cover. When sampled with the inclined point-frame the tops exceed the frame and only the stems are hit by the pins. These plants are rather heavy, however, and contribute much to herbage production. This probably accounts for the low, non-significant correlation coefficients obtained with both methods of measurement.

Growth form apparently was responsible for the somewhat lower correlation coefficient obtained for annual grass. This particular species, little barley *(Horedum pusillum)*, was mature at the time of sampling and consisted of only a compact seedhead and very short leaves. This growth form did not give a high number of hits but contributed a substantial amount of herbage. This species was found only on the rootplowed area in sufficient quantity to obtain data because the plowing operation left large areas of bare ground.

Summary

Both plant frequency and cover appeared to give reliable estimates of herbage production, based on 20 clipped plots and 200 point contact samples on each study area. Although samples were drawn from three areas which had rather different composition, there was very little difference in the correlation coefficients obtained on each.

Table 4. Correlation Coefficients for Plant Cover (Total Hits) and Herbage Production on the Three Study Areas.

Area	Buffalo Grass	Tobosa Grass	Weeds	Annual Grass
Non-treated	0.859*	0.968*	0.387	
Sprayed	0.933*	0.946*	0.279	
Rootplowed	0.919*	0.904*	0.428	0.678*

*Highly significant (.01 level)—to be significant at P = .05 — 0.444, P = .01 — 0.561.

Table 5. Correlation Coefficients for Plant Frequency (One Hit Per Pin) and Herbage Production on the Three Study Areas.

Area	Buffalo Grass	Tobosa Grass	Weeds	Annual Grass
Non-treated	0.875*	0.829*	0.573*	
Sprayed	0.892*	0.807*	0.337	
Rootplowed	0.802*	0.852*	0.381	0.622*

*Highly significant (.01 level).

Growth form appeared to be the factor determining the adaptability of the methods. Modifications could probably be made on the point-frame to take these differences in growth form into account.

LITERATURE CITED

ARNY, A. C. AND A. R. SCHMID. 1942. A study of the inclined point quadrat method of botanical analysis of pasture mixture. Jour. Am. Soc. Agron., Vol. 34, No. 3.

DREW, W. B. 1944. Studies on the use of the point quadrat method of botanical analysis of mixed pasture vegetation. Jour. Agric. Res. 69:289-297.

GOODALL, D. W. 1952. Some consideration in the use of point quadrats for the analysis of vegetation. Austra. Jour. Sci. Res. Series B, 5:1-41.

HEADY, HAROLD F. AND LYNN RADER. 1958. Modifications of the point-frame. Jour. Range Mangt. 11:95-96.

LEVY, E. B. AND E. A. MADDEN. 1933. The point method of pasture analysis. N. Z. Jour. Agric. 46:267-279.

MERNEY, N. S. 1960. A modification for the point-frame method of sampling range vegetation. Jour. Range Mangt. 13:261.

SNEDECOR, G. W. 1956. Statistical methods. Iowa State College Press. Ames, Iowa. pp 534.